Argument diagramming and planning cognition in argumentative writing

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Thought and speech is the same thing, but the silently occurring inner dialogue of the soul with itself has been specially given the name of thought

Plato, Sophist 263. Hall, 1967, p.386

Abstract

It is believed that argument diagramming can scaffold the process of argumentation. However, only a few studies have investigated the impact of argument diagramming on the quality of argumentative writing. This research contributed to this direction with two studies.

An exploratory study investigated the impact of argument diagramming, applied as a paper-based or a computer-based method, on the quality of argumentative text. The latter was found to increase refutation and overall quality of essays. The study highlights the significance of writers' argumentative ability for interpreting improvement.

A qualitative study looked into the impact of argument diagramming on the process of writing cognition through analysis of online process data, diagrams and essays based on analysis of sixteen undergraduate students. Writers with myside bias schema used the method to increase counterarguments and refutations. The method assisted writers at lower level of pseudo-integration to adopt more advanced strategies like weighing, and writers at middle level of pseudo-integration to form sophisticated positions such as positions with qualifications or contingent positions. Needs at higher levels of argumentative ability are not met.

Argument diagramming may accommodate the representation of weighing strategies but cannot represent conciliatory positions. The support of writing planning processes through argument diagramming affects mainly the semantic aspects of the text while the support of linearization processes affects mainly the rhetorical aspects.

The analysis of interviews revealed that interacting with argument diagramming can improve awareness of argumentation schema, hence a writer can progress from unaware, to aware-and-lost and aware-but-oriented. Improvement is signified as being sensitised to the own limitations, gaining knowledge of writing processes and the ability to self-regulate.

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Chapter 1 Introduction

The importance of argumentation dates back to the art of oratory in Ancient Greece. During that time, oratory was the means of achieving success in public life and a requirement in practising citizenship. Nowadays, written argumentation, the interpretation and production of it, is highly valued in educational and professional life. Essay writing is one of the main methods of assessment for academic and professional qualification (Andrews, 1995).

The importance of written argumentation is associated with the importance of learning (Andriessen, Baker, & Suthers, 2003; Jackson, 2002; Mayher, Lester, & Pradl, 1983). This is experienced when for example, we write a report of what we observe in a science laboratory, or when we try to synthesise material gathered from multiple sources for a social studies paper. The actual process of doing such writing furthers our knowledge within any discipline. In agreement with a constructivist approach to learning (Duffy & Jonassen, 1992), knowledge can be actively constructed by the learner. Through argumentative writing the learner makes her own connections, builds her own meanings and forms her own position.

Everyday and political discourse does not always help us to improve argumentation skills. In times when everyday and political discourse is undermined by biased and underdeveloped arguments, sound argumentation skills are of great importance. Instruction on the principles of good argumentation may help in identifying flaws in an approach and raise people's understanding on a topic and therefore enable wiser decisions. Instruction on the structure of written argumentation integrates elements and procedures that contribute to formulating clear, balanced, and coherent text and therefore more solid conclusions.

1.1 Motivation for research

A lot of studies have shown that writers of varying age groups and abilities demonstrate weaknesses and envisage difficulties with argumentative writing (Crowhurst, 1991; Freedman & Pringle, 1984; Knudson, 1991; Nussbaum & Schraw, 2007; Oostdam, de Glopper, & Eiting, 1994; Santos & Santos, 1999; Stapleton, 2001). Writers sometimes do not develop clearly their opinion. They do not recognize or respond to opposing viewpoints and counterarguments. They find it difficult to integrate different arguments and opinions in one position. Writers appear to lack knowledge of argument structure. Especially during transitional periods, such as between school and university, the requirements of academic and scientific writing impose greater demands on knowledge of argument structure. At a basic level, the challenge for the writer is to present a position, to integrate arguments of others and other evidence in order to strengthen or weaken the position (Coirier, 1996; Mitchell, 2001; Voss, Perkins, & Segal, 1991). Where appropriate, the writer has to refute challenging arguments in order to strengthen her position. Other strategies involve weighing evidence and arguing about how one side outweighs another. Synthesis of different approaches in one defining the conditions under which they apply is also another approach to integration of different views. Irrespectively to the employed strategies, the position of the writer and the reasoning process leading to the position should be accessible. In doing so, and before reaching their position or conclusion, writers may have to think dialogically but write in a monological form. They have to master the structure and the form of argumentative text so that the generated rhetorical structure reflects a dialogue between an arguer and an opposing arguer (Dellerman, Coirier, & Marchand, 1996; Golder & Coirier, 1994). Adversarial and conciliatory practices between two or more arguers are also reflected in the written argumentation strategies and argument structure.

The difficulties and weaknesses writers envisage while composing argumentative text are commonly related to lack of knowledge of argumentation structure or an inadequate argumentation schema. (McCormick, 2003; Nussbaum, 2008; Piolat, Roussey, & Gombert, 1999; Wolfe & Britt, 2008; Wolfe, Britt, & Butler, 2009). An argumentation schema is a mental pattern for organising arguments, which underpins the organisation processes, such as planning, translating, and revising an argumentative text (Piolat et al., 1999). It encompasses the goals a writer sets when composing text, e.g. to convince an audience about a position, but also the argumentation strategies the writer uses for achieving them. Argument schemata are conceptualised as structures with elements such as supporting claims, counterarguments and refutation and are often represented with argument diagrams consisting of textual components and links (McCormick, 2003; Toulmin, Rieke, & Janik, 1984).

The perspective of the cognitive psychology of writing, such as the two influential frameworks of Flower and Hayes (1981a), and Bereiter and Scardamalia (1987) illustrate the difference between novice and expert writers. Flower and Hayes theorized that writers set top-level rhetorical goals for a writing task, generate subgoals, then retrieve and organize knowledge to satisfy these sub goals. Bereiter and Scardamalia (1987) explained the generation of sub goals through the interplay between the content and the rhetorical problem spaces. In the content space the writer asks questions like “What do I mean?”, while in the rhetorical space the writer focuses on “What to say?” The interplay between the content and rhetoric problem spaces is null or limited amongst novice writers. Expert writers set sub goals in the content space that sub serve these rhetorical goals. Both models (Bereiter & Scardamalia, 1987; Flower & Hayes, 1980) concede that skilled writers are able to translate high-level goals into sub goals, while novice writers have not develop the strategies for doing so or lack the knowledge of how to successfully achieve these goals.

However, little is known about how rhetorical goals successfully interact with content sub goals. Forming a position about a topic may motivate the interplay between rhetorical and content space however the actual process varies between writers. A writer for example, setting out from an incomplete or inadequate schema, "could focus on favourable evidence and ignore counter-evidence, fabricate support, appeal to prejudices or misconceptions, rely on a fallacy such as the ad hominem argument, or appeal to authority" (Klein, 1999 p.250). Following Klein's (1999) critique there is insufficient evidence about the processes that contribute to the successful interplay between rhetorical and content spaces, especially in the context of instruction. There is evidence, for example that clarifying the rhetorical goals improves argumentative writing (Ferretti, MacArthur, & Dowdy, 2000) but we do not know what processes contribute to this improvement. The cognitive models of argumentative writing describe the processes in which writers of varying expertise engage. But they fell short of discussing the evolution of these processes, especially in relation to improvement induced by educational interventions. Effectively the question raised is 'how argumentative writing processes improve when educational interventions are carried out?'

A number of methods have been developed to instruct argumentative writing, for example reading and analysing argumentative texts, collaborative discussion in the classroom, explicit teaching of rhetorical goals; see Newell, Beach, Smith, & Van Der Heide (2011) for a review on argumentative writing instruction methods. A prominent method amongst them is the method of *argument diagramming*. Argument diagrams are beneficial in the instruction of argumentative writing as they visualise and scaffold the development of argumentation structure. Writers are empowered to reflect on their argumentation strategies and their argumentation schemata in anticipation of improving the processes involved in writing. Research regarding the planning cognition of writers, attests to the importance of argument

diagrams, and outlines for both novice and expert writers (Isnard & Piolat, 1994; Kellogg, 1990).

The value of argument diagramming is that it focuses on argumentation specific goals. For instance, another method that can be used to scaffold the composing of argumentative text is the method of concept mapping including a network view, where users can plan their arguments, an outline view, where users linearize the arguments and organize the rhetorical structure (Diehl, Ranney, & Schank, 2001; Kozma, 1991; Streitz, Hannemann, & Thuring, 1989). However concept mapping does not implement argumentation structure and therefore concepts and ideas are interlinked without argumentation specific goals. In contrast the argument diagramming method relates the generated concepts and ideas with argumentative schemata, enabling an argumentation-driven process.

The theoretical underpinning of the rapidly growing area of argument diagramming draws on the area of external representation and external cognition (Scaife & Rogers, 1996; Stenning, Cox, & Oberlander, 1995). External representations imply the process of externalising internal structures, such as argument schemata. Interacting with external representations, i.e. comparing and contrasting internal and external representations, may lead to cognitive benefits, depending on the properties of external structures, the level and the complexities of internal ones, and the quality of the in-between dialogue. Interacting with external representations may also lead to metacognitive benefits involving the activation of awareness about the adequacy of internal structures (Kirsh, 2005).

Argument diagrams help to visualise argument schemata, and provide a platform for interacting with them (Kirschner, Buckingham Shum, & Chad, 2003). This is done by entering content in the graph slots, overviewing the generated structures, establishing links between components, identifying missing premises, and extending the structures using

specified argument ontologies. Argument diagrams make argument relations salient, visualise the balance between arguments, counterarguments and refutations. Thus they provide an overview to how arguments interlink and contribute to the formulation of a position. The visualisation of argument components on diagrams and the interaction with them is believed to "activate, strengthen, and refine the existing schemata or help to develop new ones" (Nussbaum & Schraw, 2007, p.65).

Some studies examine the *impact of argument diagrams on argumentative essays* (Lin, Strickland, Ray, & Denner, 2004; Nussbaum & Schraw, 2007; Okada, 2008; Suthers, Toth, & Weiner, 1997; Yeh, 1998a). The results of empirical studies are in general positive. However most of these studies rely on collaborative planning where writers interact in groups before they get to write an argumentative essay individually. As a result the abilities and strategies of individual writers are obscured by the abilities and ideas of other members of the group, offered during the phase of collaborative planning. It is not yet clear if the dialogical schema exhibited during collaboration is transferred to the written text (Gillies & Khan, 2009; Newell et al., 2011). Individual writers need to develop their own dialogical thinking schema. Very often writers are expected to produce an argumentative essay without access to a collaborative group.

Furthermore most of these studies embark on an overall assessment of the produced essays, failing to address specifically the argumentative structure of the essays. The assessment is thus based on a holistic, reader-focused scoring, assigning an overall judgement on a given set of criteria. Linguistic difficulties, digression and coherence issues, can obscure the underlying effort of the writer to develop complex and sophisticated argument structure. And conversely, aptitude in written discourse may enhance the persuasiveness. This can mislead the rater to overlook the lack of complex argument structures which convey critical thinking skill and

sound dialectic arguments. Both holistic ratings and analytic measures, which involve structure analytical approaches, are valuable in evaluating writing performance (Kellogg, 1994).

Even fewer studies examine the *scaffolding of the argumentative writing process through the use of argument diagrams* (Baker, Andriessen, Lund, van Amelsvoort, & Quignard, 2007; Erkens, Jaspers, Prangsma, & Kanselaar, 2005; Kozma, 1991; Okada, 2008; Proske, Narciss, & McNamara, in press). Despite the value of these studies, the evidence on this field is clearly insufficient and considerably more evidence is required to draw safe conclusions. More studies are required to explore issues such as 'what planning cognition processes are enhanced by the use of argument diagramming?', 'in what way does planning cognition change as a result of argument diagramming?'. These issues should be explored taking into account factors such as the argumentative writing skill of writers, before writers are introduced to argument diagramming, and their awareness of argumentative writing strategies.

It is possible to approach planning cognition from two perspectives: (i) first, the actual cognitive process and strategies that can be inferred through observing the writer on task and analysing intermediate and final products (e.g. plans and final texts) and (ii) second, the writers' metacognitive awareness about the processes and strategies involved in planning, linearizing and writing. The importance of writing metacognition in writing instruction is well established (Englert, Raphael, & Anderson, 1992; Harris, Santagelo, & Graham, 2010). Experienced writers are more aware than novice writers about the processes they engage in when writing (Englert et al., 1992; Graham & Harris, 2009; Lin, Monroe, & Troia, 2007) and can discern better the successful writing process and the effective written products (Raphael, Englert, & Kirschner, 1989; Saddler & Graham, 2007). The impact of instructional interventions on the writers' metacognitive awareness has been explored by a small number of

studies (Conner, 2007; Felton & Herko, 2004; Igland, 2009). However the impact of the argument diagramming on the meta-cognitive awareness of writers in argumentative writing has not been discussed to date. If the argument diagramming is an important scaffolding method for argumentative writing, the way this method affects the awareness of writers should be explored.

Finally some studies examine the scaffolding of argumentative writing through *paper-based argument diagramming* (Nussbaum, 2008; Nussbaum & Schraw, 2007; Yeh, 1998a) while other studies look at *computer-based argument diagramming* (Erkens et al., 2005; Lin et al., 2004; Okada & Buckingham Shum, 2008; Suthers et al., 1997). The area of computer-supported argumentation has been growing rapidly over the past two decades with research studies involving computer-supported argument visualisation (Andriessen et al., 2003; Kirschner et al., 2003; Okada, Buckingham Shum, & Sherborne, 2008; van Gelder, 2001, 2003) pointing out the benefits and challenges of the computer-based approach. Two comprehensive reviews (Noroozi, Weinberger, Biemans, & Mulder, 2012; Scheurer, Loll, Niels, & McLaren, 2010) drawing from more than 150 papers, point out to a plethora of computer-supported argumentation tools and empirical studies. Others, like Harrell (2008), argue that teaching paper-based argument diagramming can benefit critical thinking substantially. Although both paper and computer-supported argument diagramming interventions are examined it is not clear how the one compares to the other. The two discussion threads are largely kept apart (Sturm & Rankin-Erickson, 2002) A discussion is needed to identify the strengths and weaknesses of each medium, and how the affordances of each relate to the process and outcome of planning cognition.

1.2 Research questions and the research approach

The wide range of theoretical approaches and experimental studies as well as the research gaps in the existing literature, discussed in previous sections of this chapter, set the theoretical context and problem statement of this research project. The aim of the research is to explore:

How argument diagramming, used as a planning method of argumentative essays, affects the planning cognition of argumentative writing.

In order to investigate the *planning cognition of argumentative writing* this research explored i) the outcomes of planning, i.e. the intermediate plans and the final text ii) the argumentative writing process while planning an essay, and iii) the metacognition of writers about the argumentative writing process. As argument diagramming can be equally applied on computer and paper, both planning media were explored, making a comparison between the two whenever this was possible.

The investigation of the research started from exploring the impact of argument diagramming on the quality of text in order to understand the textual and argumentation structure changes that occur as result of using argument diagramming. Two subsidiary research questions initiated the understanding of planning cognition:

RQ1a. Does argument diagramming administered as a computer-based method improve significantly the quality of argumentative essays?

RQ1b. Does argument diagramming administered as a paper-based method improve significantly the quality of argumentative essays?

The analysis of text highlighted an important change in argumentation structure in response to RQ1a, that is, the users of computer-based argument diagramming increased the refutation elements. Nevertheless, competing interpretations of the results of studies 1a and 1b,

(corresponding to RQ1a and RQ1b respectively) −partly owed to limitations in the design of the studies and partly to lack of process data− obscured the reasons why using the paper-based argument diagraming did not improve refutation in the final text. In other words, text analysis alone was insufficient for understanding how argument diagramming affects planning cognition. Nevertheless, the interpretation of the results of studies 1a and 1b, provided a stepping stone and motivation for conceptually advancing the research investigation towards exploring the quality of argumentative text in conjunction with the argumentative process and strategies of the writers. Thus, the research introduced the second research question which is:

RQ2. How does argument diagramming as a method of supporting the planning of argumentative essays affect the cognition of argumentative writing process and the quality of argumentative text?

RQ2, the main research question of the thesis, explored how argumentative writing processes lead to specific changes in text and argument structure, when the writers used argument diagramming. During this exploration stage, the text analysis focused on investigating a wider range of argumentation structure phenomena compared to the previous stage of research (RQ1a and RQ1b). The change in quality of text was defined through a change in argumentation schema (semantic argumentation structure) and ability to convey this linguistically (rhetorical argumentation structure), while the level of baseline argumentative writing ability was also taken into consideration. This exploration generated a lot of new insights into the way the use of argument diagramming shapes the planning cognition of argumentative writing, but it also highlighted a significant issue as to whether such change in planning cognition, observed through the simultaneous analysis of text and process, was equally perceived by the writers. Evidence of writers' awareness of the occurred changes in planning process would provide a more complete account of the impact of argument

diagramming on planning cognition. At this point the research furthered the investigation by eliciting the writers' metacognitive awareness about the argumentative writing process. As a result the following subsidiary research question was developed:

RQ3.What is the impact of argument diagramming on metacognitive awareness about argumentative writing?

The research undertaken in this thesis is exploratory in nature. A number of qualitative research tools and methods were used to analyse the data, especially in response to questions RQ2 and RQ3. This was because the very nature of these research questions lends itself to qualitative research and exploratory approach. A number of measures were implemented (e.g. random allocation of participants to essay topics and to paper and computer conditions) in order to reduce the risks of having unbalanced groups and minimise the impact of intervening factors. Nevertheless, the overall research approach was characterised by exploratory activities rather than controlled laboratory studies.

The qualitative method of analysis, that was adopted in order to explore the quality of essays, the writing process, and metacognition, allowed important themes and factors to emerge that were significant for the understanding of planning cognition and how it changes with argument diagraming. For instance, the level of argumentative ability, represented by a range of argumentation schemata, emerged strongly and defined the method of analysis and discussion of results. In other words, during the analysis, the participants were categorized in subgroups depending on their argumentation schema, and this proved to be a more important factor than the paper and computer condition comparison. However, for question RQ2 and RQ3, whenever there were participants in the same subgroup, who applied argument diagramming on paper and on computer, a comparison was conducted in order to explore differences in the affordances of the two planning media.

Finally, it should be also noted that the investigation of RQ1a and RQ1b is carried out with the Dialectic Method. The Dialectic Method (DM) is a method of planning argumentative writing which can be administered as a computer-based method (Computer DM) and as a paper-based (Paper DM) in order to scaffold the planning and translating of argumentative essays. The computer-based method employs a prototype diagram editor which was built in order to integrate a specific argument notation. In the course of this investigation more computer systems that integrate a similar argument notation were developed. For the investigation of RQ2 the *Rationale 2* ™, commercial software fulfilling similar requirements, was used.

Overall, the investigation of RQ1a and RQ1b provided a stepping stone to explore the main research question, RQ2; through the exploration of RQ2 the importance of metacognitive awareness of writers was identified, and so RQ3 advanced further the investigation of the planning cognition. While RQ2 carries the focus of the research RQ1a RQ1b and RQ3 should be considered as subsidiary questions.

1.3 Thesis outline

Chapter 2 presents the research background of this thesis. The main reasons and empirical findings that motivate this research are analytically presented together with the evidence accumulated by existing research.

Chapter 3 explores RQ1a and RQ1b. It investigates the impact of the Dialectic Method on the quality of argumentative essays with studies 1a and 1b. The study adopts a pretest-posttest design and a comprehensive approach to evaluating the quality of essays. The Chapter discusses findings related to an increase in overall quality and refutation as result of using the Computer Dialectic Method.

Chapter 4 presents the method and measures employed in exploring RQ2. The investigation of this RQ is undertaken with study 2.

This is a qualitative study exploring, first, the impact of argument diagramming on writing process cognition and the quality of argumentative text (RQ2). Change in *argumentative writing process cognition* is inferred through observing the writer at task (pretest essay and posttest essay) and associating it with *critical improvements* in the quality of produced text. The results from this investigation are presented in Chapter 5.

Then the investigation turns to the *writers' metacognitive awareness* about the processes and strategies involved in planning, linearizing and writing (RQ3). Chapter 6 reports on the analysis of interviews that took place soon after the completion of the baseline essay and the posttest essay. The analysis focused on changes in *writers' metacognitive awareness* as results of using argument diagramming. The concept categories and the conceptual framework that emerged from the interview analysis are presented.

Chapter 7 presents the conclusions of the thesis, responding to the research questions, offering some new insights for the theory, discussing the implications of this research for schools and computer-aided learning and proposing new directions for further research.

Chapter 2 Theoretical review and previous research

A lot of studies have shown that students of varying age groups demonstrate weaknesses in argumentative writing (Crowhurst, 1991; Freedman & Pringle, 1984; Knudson, 1991; Nussbaum & Schraw, 2007; Oostdam et al., 1994; Santos & Santos, 1999; Stapleton, 2001). Students do not clearly support their own opinion, they do not recognize or respond to opposing viewpoints, they find difficulties in integrating different perspectives in one opinion, and they lack knowledge of argumentation structure. The student needs to master the skill of formulating structure that reflects a dialogue between an arguer and an opposing arguer (Dellerman et al., 1996; Golder & Coirier, 1994; Nussbaum & Schraw, 2007).

This chapter presents theoretical and empirical aspects regarding to how writers generate and are supported in generating argumentation structure. The ability to structure and compose argumentative text relies to a great extent on knowledge of argumentation structure and the process underlying the formulation of this structure. Writers benefit from i) knowledge of *argumentation schemata* that drives the generation of argumentation structure (Section 2.2), ii) knowledge of the *processes* involved in generating them (Section 2.3), and iii) *awareness* of own strength and ability in managing them (Section 2.4). *Argument diagrams* represent graphically aspects of argument schemata, scaffolding the writer in generating argument structure while she visualises the structure and interacts with it.

The research regarding the effects of prewriting are in general positive, however the level of expertise of the writer, the context of use of the strategy, the type of strategy are discussed in interpreting divergent findings. In this context the value of argument diagramming is seen as a genre specific strategy with many advantages in scaffolding the writer in generating argumentation structure.

2.1 Argumentation Approaches and Models

A number of scholars and researchers have analysed the argumentation from different perspectives and several of them developed their own models in an attempt to formalise the argumentative structure. It is beyond the scope of this thesis to review all existing argumentation models but three wider categories of argumentation models are identified as having special value for the argumentation research.

Piolat et al (1999) distinguish two generic categories of argumentation models: (a) those which "consider that argumentation is essentially a justification" (p. 119) and (b) those which "consider argumentation to be a process of dialogue" (p. 119). They argue that the former focus primarily on the justifying character of the argumentative activity, assigning to refutation a secondary role. As for the latter category, it requires the identification of opposing arguments which "must be co-ordinated" (p. 119) in a final text and an ultimate position.

Three categories of argumentation models can be identified, each one implying a different approach to argumentation. The first category, the *analytic*, is characterised by the justification of the selected position and a method of advocacy similar to what lawyers, are trying to do, namely "to win a conflict by convincing a ruling authority that their claims should be honoured" (van Bruggen, Boshuizen, & Kirschner, 2003 p. 31).

The second category is what can be termed as *design oriented* in a context where a decision should be taken with regards to an action or a problem. The requested action or problem is decomposed into issues or aspects that need to be considered, advantages and disadvantages of alternatives or possible solutions are explored and weighed and, with certain pragmatic constraints such as time and costs taken into account, a decision is made.

The third category, focusing on the *dialectical dimension,* argumentation involves the procedure for regulating discussions among people. Doubts and criticism, coming from a real or imagined antagonist, are dealt with not just by valid reasoning but by taking into account rules of critical discussion. Deliberation over opposing positions, counter argumentation and refutation is closely associated to the dialectical dimension. Refutation or counter rebuttals invalidate counter argumentation by attacking them with new arguments.

Category of argumentation models	**Analytic**	**Design-oriented**	**Dialectic**
Goal (as noted in the section above)	‘ to determine components of inference making from an informal logic point of view’	‘a decision needs to be taken with regards to an action or a problem’	‘explore structure of opposing beliefs or positions’
Structure	Components of the conclusion-premise macrostructure	Problem decomposition, appreciation of alternative solutions	Opposing positions, positions are supported and challenged.
Typical example	Toulmin	IBIS	Kopperschmidt

Table 2.1: Argumentation models of the three categories

Each of these categories has an inherent logic (Table 2.1), relying on different approaches to the issue of argumentation. The next sections discuss in more detail these categories, referring to typical models representing each category. Although the list of the reviewed models is by no means exhaustive, it can help the discussion to realise the limits of each approach and the criticism the relevant models have received.

2.1.1 Analytic models

These argumentation models are mainly concerned with determining important components of inference making. A method of advocacy underpins the inference making mechanism which underlies the conclusion-premises macrostructure while argumentation is mainly seen on a microstructure level. The analytic models are widely applicable in legal argumentation (Bench-Capon, Leng, & Stanford, 1998; Carr, 1999; Marshall, 1989; Verheij, 1998).

One of the most influential models of this category (as well as in the study of argumentation) is Toulmin's model (Toulmin, 1958; Toulmin et al., 1984). It was introduced as an alternative to formal logic, suitable to represent practical reasoning in everyday argumentation. It proposed a prototypical schema of six elements, which elaborates the basic argumentation structure (Figure 2.1):

(1) *Claim* is the conclusion of an argument, a potentially controversial, observation, prediction or characterization;

(2) *Data* supporting a claim which may comprise of experimental observations, matters of common knowledge, statistical data, personal testimony, previously established claims, or other comparable factual data;

(3) W*arrant,* the logical step between claim and data, expressed as a general rule of inference. Warrants can be general statements or, depending on the kind of claim, laws of nature, legal principles and statuses, rules of thumb, engineering formulas, and so on.

The data-claim-warrant structure constitutes the inferential core of the argument. Three more elements extend the model:

(4) *Backing,* i.e. the validation of the warrant and its strengthening;

(5) *Rebuttal* to the rule established by the warrant, for instance counterarguments or exceptions;

(6) *Qualifier* or expressing a modified degree of accepting the data-claim-warrant structure.

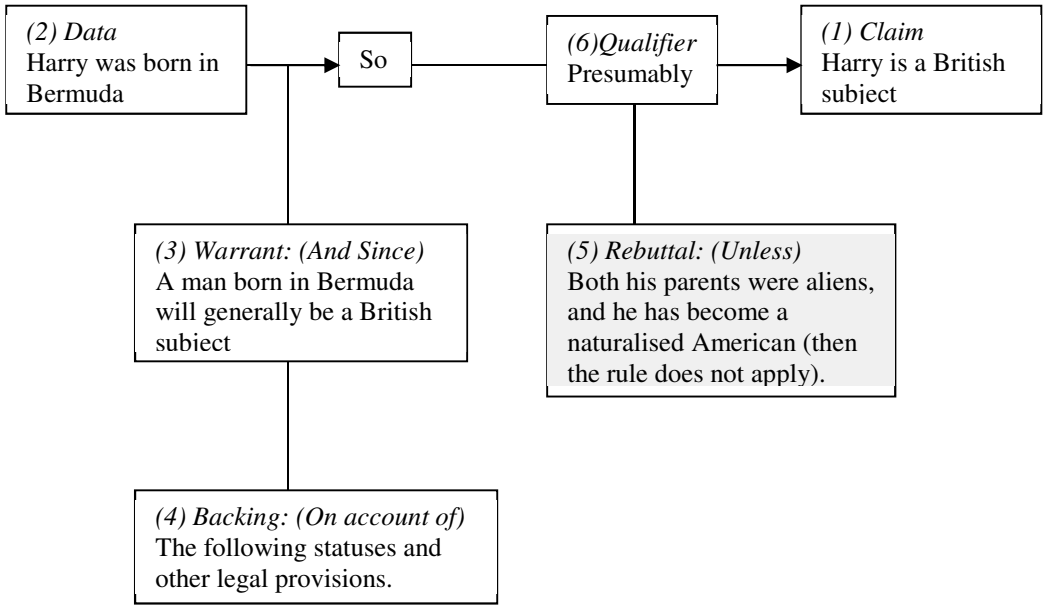


Figure 2.1*:* Toulmin's six-element model

2.1.2 Strengths and weaknesses of analytic models

Many authors have applied and evaluated Toulmin's model in various contexts: Gasper and George (1998) in analysing public policy argumentation, Newman and Marshall (1992) in representing legal argument, Hair and Lewis in comparing alternate argumentation formalisms (1991), Lunsford (2002) in teaching written argumentation, and Freeman (1991) in theories of argumentation macrostructure.

The model has been acclaimed for analytical strength. Newman and Marshall (1992) acknowledge that the represented structures are general enough to capture the basic inferential structure of clear argumentative discourse. The questions provide support in generating argumentation structure elements The model directs the arguer to determine important parts of

an argument and to state inferences and principles, which may otherwise be implied or omitted (Gasper & George, 1998). Responding to the questions may lead to deeper analysis of argument, and better understanding of argumentation (Hair & Lewis, 1991).

Rebuttals, as well as the related issue of representing conflicting positions or claims, are probably the weakest and the most underdeveloped aspects in Toulmin's model (Crammond, 1997; Newman & Marshall, 1992 p. 16) . The only possibility to counter argue a claim or a qualifier is with the rebuttal. However, refuting this counterargument is not anticipated. The model fits an argumentative monologue rather than a dialectic representation of argumentation.

The model has also been criticised for restricted potential to cover complex argumentation structures (Crammond, 1997; Gasper & George, 1998; Hair & Lewis, 1991; Lunsford, 2002; Newman & Marshall, 1992; Snoeck Henkemans, 2000; van Eemeren, Grootendrorst , & Snoeck Henkemans, 1996). Toulmin articulated his proposal for the layout of arguments in the context of a single use of argument, that of justifying one's assertion in response to a challenge (Toulmin, 1958). The limitation here is, claims cannot be put against each other such as refutation and other structures that include subordination and coordination of reasons and are generated on the basis of at least two opposing arguers (Snoeck Henkemans, 1992, 2000). Problems have been reported in connecting different parts of a large argument into a unified structure (Hair & Lewis, 1991; Hankemans Snoeck, 1992).

2.1.3 Design-oriented models

In the design-oriented category, defined earlier, argumentation is related to real life problems as a process of dealing with ill-structured (Newell & Simon, 1972) or wicked (Rittel, 1972)

problems. These are problems that are difficult to define and they cannot be analysed with established methods.

In a context where a decision should be taken with regards to an action (e.g. 'Should we use web-based databases for patient's records?') or a problem (e.g. 'What type of databases are appropriate for patients' records?'), the implications of the decision need to be carefully contemplated. An underlying structure is designed to facilitate a decision, in terms of alternative solutions: there may exist better or worse solutions, but not wrong or right ones.

There is no clear rule as to when a solution is reached. Complex judgments are required about the level of abstraction at which to define the problem. Closure is usually reached given pragmatic factors, for example time and managerial constraints (Buckingham Shum, 2003; van Bruggen et al., 2003).

Rittel's work (1970) on the Issue-Based Information System (IBIS) supports the process of (i) recording design decisions during the actual design for future reference and (ii) clarifying the available options and try to reason about which one is better (Dix, Finlay, Abowd, & Beale, 1993). The IBIS hierarchical structure is organised in terms of issues and positions. The approach uses a question-and-answer format to encourage the participants to explore the problem space of the design process (Hashim, 1991). A *root issue* represents the main problem, usually phrased as a question. The question is addressed with *positions,* which are potential answers to the question. Each position can be supported or objected to by *arguments*. The difference between issues and positions is that issues can be broken down to further *sub-issues,* while positions are supported or objected to by arguments (Figure 2.2 and Figure 2.3). Sub-issues can be expanded into new issues and new positions refer to them (Dix et al., 1993).

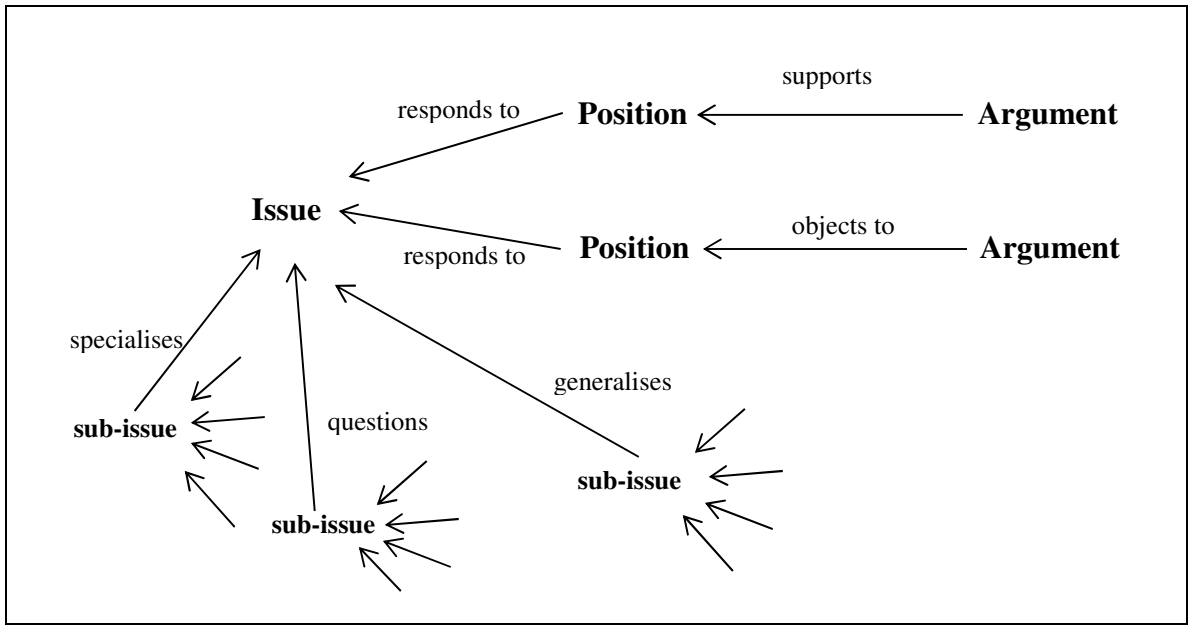


Figure 2.2: gIBIS: (Dix et al., 1993p. 183)

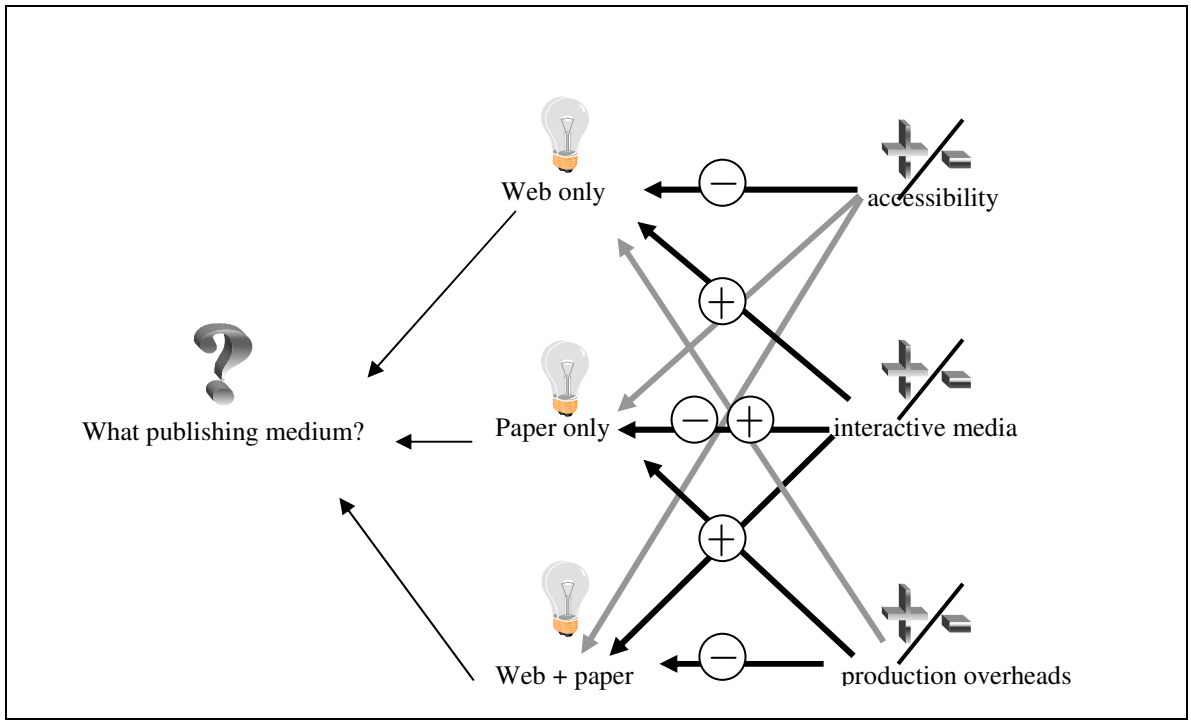


Figure 2.3: An example of the graphical IBIS (gIBIS) notation (Conklin & Begeman, 1988)

The understanding of planning and design, as a process of argumentation, has led to the use of IBIS as a methodology for design which needed to be relatively open-ended, participatory and

taking into account the dialectic between goals and possibilities (Stefik et al., 1987). It became the representational basis for capturing the design rationale (DR) involving reasoning about the design of an artefact. Design Rationale involves structuring and keeping track of the process and decisions between intermediate design phases and artefacts, such as requirements specifications, and prototype building (Buckingham Shum, 1997; Buckingham Shum & Hammond, 1994). It refers to a decision or an action that needs to be taken in view of alternative solutions, for which advantages and disadvantages can be expressed.

A number of notational languages, such as the QOC (Questions, Options, and Criteria) notation (Shum, MacLean, Bellotti, & Hammond, 1997), PHI (Procedural Hierarchical IBIS) (McCall, 1991), gIBIS (Conklin & Begeman, 1988) have been introduced, following the idea behind IBIS (Buckingham Shum & Hammond, 1994, p.7). The Decision Representational Language (Lee & Lai, 1991) for supporting debate and qualitative decision-making introduces new constructs. It allows one to explore *Alternatives* and *Claims* that back them, and to contest the relationships between these and Questions and Counter-Claims. QOC helps to define a Design Space Analysis, where key problems are identified (Questions), and design alternatives (Options) are justified (via Criteria). Design Space analysis focuses on 'retrospectively rationalising the Design rationale'. PHI (Procedural Hierarchical IBIS) (Hashim, 1991; McCall, 1991) is an elaboration of IBIS, using a similar set of elements with new relationships between them.

2.1.4 Strengths and weaknesses of design-oriented argumentation models

A valuable contribution of the design-oriented models has been that the emphasis on the planning and design phases of the process, where the nature of the issue is being discussed. For instance IBIS captures elements and processes important in supporting an argumentation approach in design (Buckingham Shum & Hammond, 1994). It also captures the notion of

hierarchy, ranging from a general conceptualisation of the problem, to involved issues and sub issues, to positions expressed. The concept of conclusion is represented implicitly if one highlights the path that represents the implementation or final design decision.

Another important contribution of the design-oriented models is the introduction of multiple perspectives in the argumentation process. For instance the IBIS model enables the participation of several participants, allowing high levels of transparency and a collective sense making. The model has found very valuable application in cases of dialogue mapping to map out a design dialogue as it evolves (Conklin, 2005). The exposure to different alternatives and ideas can lead to the best solution, although the arguer has to identify his/her own criteria. The structure of argumentation can help with externalising the reasoning process.

On the other hand, comments about 'premature structuring' and 'cognitive overhead' are reported in many studies (Conklin, Selvin, Buckingham Shum, & Sierhuis, 2001). Problems may arise when the generation of ideas is 'forced' before they are ready. For instance ideas at early stages of problem solving do not have carefully thought out structures (van Bruggen et al., 2003). Shum also argues that it is more important to formulate and reformulate the design problem rather than immediately present backing of arguments or a neat reasoning structure (Shum, 1991 p. 337).

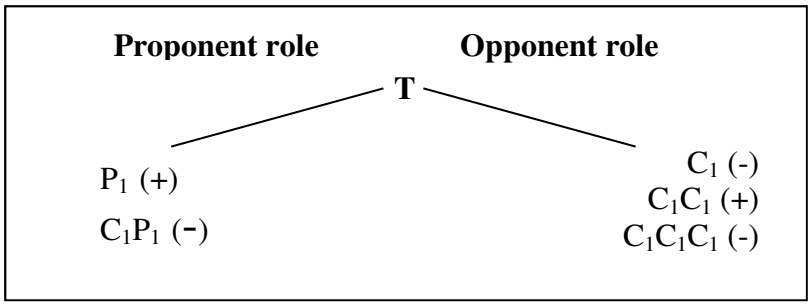
It has also been reported that difficulties have been encountered with classifying the contribution of participants, articulating ideas succinctly and structuring how an idea relates to another (Kirschner et al., 2003). The effort required in encoding ideas into discrete nodes, with distinctive names and types is "comparable to the development of fluency in a new language – it is a whole new literacy" (Conklin et al., 2001, p.2). These tasks can be intrusive in a brainstorming mode. Problems are related also to the difficulty or even of unwillingness

to use formalism for representing knowledge. Fear of premature commitment might also be a reason, especially in collaborative contexts. Even if the formalisms of the model (or the relevant system) have been well understood, representing knowledge is not easy or straightforward since a significant part of knowledge can be tacit (Shipman & Marshall, 1999). As put by Shum "increasing constraints on representational form (e.g. expanding the vocabulary) may distract attention from analysis of the problem, to representation of the analysis" (Shum, 1991, p.337).

2.1.5 Models integrating the dialectical dimension

Models integrating the dialectical dimension share with design-oriented models the multi-perspective approach for generating an argument structure. Nevertheless, in the dialectical dimension, argumentation involves the procedure not only the widening of the discussion but also the regulation of the discussion of different perspectives. This procedure brings under control the natural process of communicating aiming to persuade by suggesting the rules of critical discussion and stages in the argumentation process. These rules define also the roles and attitude of the discussion participants (Snoeck Henkemans, 1992; van Eemeren, Grootendorst, & Kruiger, 1984; van Eemeren et al., 1996). Different perspectives can come not only from real participants but also from imagined antagonists. Doubts and criticism from a real or imagined antagonist are dealt with not just by valid reasoning but also by taking into account rules of critical discussion. Deliberation over opposing positions, counter argumentation and refutation is closely associated to the dialectical dimension. Counter argumentation or rebuttals is the expression of objection to the thesis or an argument supporting a thesis. Refutation or counter rebuttals invalidate counter argumentation by attacking them with new arguments (Freeman, 1991; Kopperschmidt, 1985).

A typical model of this category is the Kopperschmidt's model (1985). In this model, refutation (or counter rebuttal) is a characteristic of the dialectical dimension, according to which opposing information must be coordinated. The model assigns less importance to the analysis of justification and the process of making explicit all unexpressed premises (see an example in Figure 2.4).



Proponent role

Argumentation Strand (left)	
(T): Atomic power plants should be built!	Contentious thesis
P_1: Only the building of atomic power plants can eliminate energy shortages in the 1980's	P_1 directly supports the thesis
C_1P_1: "The energy shortage can also be eliminated by using other energy sources"	C_1P_1 counters P_1 and indirectly weakens the thesis

Opponent role

Argumentation Strand (right)	
(T): Atomic power plants should be built!	Contentious thesis
C_1: Atomic plants are much too dangerous	C_1 directly counters thesis
C_1C_1: There are adequate safety regulations	C1C1 counters C1, indirectly supports thesis
$C_1C_1C_1$: Nevertheless, (the accident in) Harrisburg was possible	$C_1C_1C_1$ counters C_1C_1 and indirectly counters the thesis

Figure 2.4: Koppersmidt's dialectical model of argumentation

In Kopperschmidt's model, the argumentative function of a statement is defined in three ways. First, it can be defined in relation to the thesis, i.e. whether is a pro or contra argument. Secondly, a statement may be defined as pro or contra in relation to its previous statement. Third, as a result of the argument chain, a statement may support or weaken the thesis directly or indirectly. Representing argument as a tree graph "enables the user to enter several connections between one subordinate node and its superiors. A linear presentation cannot do this" (Rolf & Magnusson, 2003 p.5).

These models perceive the dialectical process in phases, although the limits between phases may vary (Freeman, 1991; Kopperschmidt, 1985; van Eemeren et al., 1984). Dialectical approaches seem to be in agreement about the first phase, *the opening phase*, where a conflict or an opposition of opinions is declared (Baker, 1999). At this point, it is important to commit to a thesis, but also to be willing to withdraw it in view of a weak defence (Snoeck Henkemans, 1992). There are two basic types of opposition: a "simple" one, in which a single thesis is debated, and called into doubt by the opponent, and a "mixed" one, in which each participant proposes a thesis (thesis and counter thesis) (Baker, 1999, p.186).

In the next phase, the *argumentation phase*, participants must make at least one communicative act that is in accordance with the positions expressed in the opening stage (Baker, 1999). The protagonist (defending a position) methodically builds his/her position against critical responses of the antagonist (opposing to the position) (van Eemeren et al., 1996). Kopperschmidt's(1985) analysis of argumentative discourse, denoting a real or imaginary exchange between participants, includes two stages in this phase: first, a segmentation of the arguments, during which arguments are invented and expressed as simple statements; second, a construction of the Argumentation Strands, when arguments are organised in argument chains.

Contrary to previously reviewed models, the dialectical models deal with the complexity of argument structure. According to Snoeck-Henkemans:

> An overall judgment of the quality of a complex argument structure requires not just clear picture of individual arguments but also insight into the relations among these arguments. A 'complex argument' is an argument that consists of a number of single arguments for a conclusion. A 'single' or 'individual' argument is the equivalent of a 'reason'. (Snoeck Henkemans, 2000 p. 447).

In a dialectical situation, the antagonist has to defend his/her position. If the antagonist is not convinced, the protagonist has to introduce new arguments. As a consequence the protagonist's argumentation may vary from very simple to extremely complex.

Finally, in the third phase, the *closing phase*, argument strands and thesis are combined together (Kopperschmidt, 1985). In Prakken's dialectical (computational) protocol for dispute each time a party adds or retracts information, the argumentation reassesses the resulting state of the dispute (Prakken, 1995, p. 165). In most cases, the participant discusses how the verbal conflict should be closed. Who is right or wrong? Who has won or lost? (Baker, 1999). A synthesis of positions may also be possible. In this case, counterarguments to the position may be acknowledged as concessions. In a dialectical situation, the protagonist and the antagonist determine whether he protagonist's position has been successfully defended.

2.1.6 The pragma-dialectical approach

A version of the dialectical category is the pragma-dialectical approach (van Eemeren & Grootendorst, 1994b; van Eemeren et al., 1984; van Eemeren et al., 1996) considers argumentation as the proceedings of a dialogue between two arguers, a protagonist and an antagonist. It is assumed that in an argumentative discussion two opposite claims are

expressed, each by the protagonist and the antagonist respectively. These claims are called standpoints, while the statements with which the arguers defend or refute the standpoints are called arguments. The standpoint and the argument are the primitive elements of this argumentative approach. In other words, the pragma-dialectical approach is 'dialectical' because it focuses on the dialectical component of argumentation.

It is also "pragmatic" because the argumentative moves involved in the dialectic approach can be understood in the specific cultural-historical contexts (van Eemeren, Grootendorst, & Henkemans, 2002, p.52). The pragma-dialectics analyses the actual deliberative process – from the emergence of a difference of opinion, to how these differences are tackled and subsequently resolved, settled or ignored. The argument an arguer puts forward, together with his or her commitments and background assumptions are made explicit in language and they are open to scrutiny and examination (Knops, 2006, p.61; van Eemeren & Grootendorst, 2004, p.53). Furthermore in the pragma-dialectic approach, it is the externalised form of reasoning that matters rather than the writer's internal reasoning process (van Eemeren & Grootendorst, 2004, p. 54). According to Feteris (2002, p. 243) "pragmatic argumentation … refers to the consequences of a decision". In similar line Hare (1952) (quoted in (Feteris, 2002, p. 245) argues that an argumentation can be supported through the reference to principles as well as the effects of applying these principles.

An advantage of considering the consequences or implications of a decision is that it clarifies a choice between various arguments, "a choice which often remains implicit … This can produce an open critical discussion" (Feteris, 2002, p. 243). On the other hand critics of the pragma-dialectic approach argue that it uses a weak justification since the consequences or implications can be used as a rhetorical technique to conceal the real reasons behind an argument.

The pragma-dialectical theory has been applied to understand several different types of argumentative discourse. For example, it has been used to analyse and evaluate literary criticism, judicial argumentation and political discourse (Curato, 2008), legal argumentation, mediation, negotiation, (parliamentary) debate, interpersonal argumentation, health communication and visual argumentation (van Eemeren, 2002).

The approach provides a useful starting point for a normative analysis of how argumentative exchanges should proceed in order to resolve a difference of opinion. In *Speech Acts in Argumentative Discussions*, van Eemeren and Grootendorst (1984) introduced a proposal for a dialectical procedure, a set of rules, in the form of a code of conduct for critical discussion. Francisca Snoeck Henkemans (Snoeck Henkemans, 1992) elaborates the pragma-dialectical discussion procedure "to establish which defensive moves in a critical discussion are an adequate sequel to which attacking moves, and in which argumentation structures these exchanges of moves will result" (p. 86).

The pragma-dialectical approach aims to provide a coherent account on the heart of argumentation by anchoring its heuristic tools on deliberation's linguistic foundations. Refutation takes an important role in the participant's critical discussion that aims to resolve a difference of opinion. A few authors (Meiland, 1981; Stein & Miller, 1991; Thomas, 1986) on argumentation structure have highlighted the importance of refutation. Snoeck Henkemans (1992) defines explicitly some of the heuristics related to refutation:

1. "Combining defensive with attacking moves enhances the arguer's chances of defending" (Snoeck Henkemans, 1992 p. 133)
2. "By showing that the other party's criticism regarding his argumentation is unjustified, the arguer has indeed successfully defended his standpoint. By refuting an argument for the opposite standpoint, he can only make his opponent withdraw this standpoint, which is of

course, not sufficient to relieve him of the obligation to defend his own standpoint" (Snoeck Henkemans, 1992 p. 132)

3. The arguer should attempt to find counter arguments and then try to refute them.

In simple terms, it is good practice to refute arguments that support the antagonist's position but it is even better if the arguer also considers the arguments threatening his/her own standpoint.

2.1.7 Strengths and weaknesses of dialectic argumentation models

Dialectical models integrate a response to some of the criticism expressed for the previous models. An important point of differentiation with other modes is that the dialectical model encourages a dialogue between different viewpoints, facilitating therefore more complex argument structures. Elements, such as the Toulminan warrant, are simplified into an additional reason while the dialectical models look closely at subordination and coordination of reasons.

There is no clear stage when a critical discussion has reached a resolution. Van Eemeren suggest that closure comes when the protagonist and the antagonist agree that a conflict is reasonably present and a position is sufficiently defended according to a rational judge (van Eemeren et al., 1996). Instead the emphasis is on the argumentation process and its regulation, with special reference to integration of arguments, counter-arguments and refutations. In this case, argumentation is more important as a process and procedure rather than as product. Emphasis on the process allows a representation of the dynamic process of argumentation and the progressive development of argument structure. By representing the process of argumentation between two real or imaginary opponents, the evaluation of arguments and the development of more complex argumentation structures are facilitated. Understanding the

structure of argumentation through generation of argumentative moves (Snoeck Henkemans, 1992) also adds to the understanding of argumentation, and consequently its analysis and evaluation.

2.1.8 Scaffolding argumentation: the interaction between models and schemata

The insights provided by the various theories and models developed has been very useful in understanding the way argumentation works (or should work). Despite the value of these insights, the argumentation models and the theories behind these models are necessary but not sufficient conditions for enabling the scaffolding of arguers from their current position to a more sophisticated argumentation stage. A much more comprehensive instruction (or scaffolding) strategy needs to be in place to enable this transition.

For these models to make an impact, the arguer should be able to reflect on the difference between what she thinks is the 'standard' practice and the new practice (as formalised in an argumentation model) either verifying or discounting this belief (Kuhn, 2002). In effect scaffolding arguers requires not only a proposal for what they have to do in argumentation but also the challenge of their long standing assumptions about argumentation and their deeply embedded argumentation practices. This process allows the identification of inconsistencies in current beliefs and the development of new assumptions and new practices (Vosniadou & Verschaffel, 2004). The long standing assumptions and deeply embedded practices are articulated in the mental representations of the arguer, i.e. the mental structures that an arguer mobilises when she decides to engage in argumentation. The term used to describe these mental representations is argumentative schemata. The next section reviews the theory about this concept and the various kinds of argumentative schemata identified by previous contributions.

2.2 Argumentation Schemata

Argumentation schemata are mental representations holding information about genre characteristics and discourse conventions. Some of the terms that have been used to describe argumentation schemata in the literature are text schemata, superstructure (van Dijk, 1980), and prototypical argumentative schemata (Brassart, 1996; Golder & Coirier, 1992; Piolat, 1999; Piolat et al., 1999).

A schema, originally introduced with the notion of mental schema (Schank & Abelson, 1977), is important in writing, especially for communicating ideas and their structure from the writer to the reader. Schemata refer to both content and organization of ideas. Readers understand a text according to their own schemata, or infer new ones, which they integrate in their own system of ideas (Ferris & Hedgcock, 1998; Sharples, 1999). Text schemata (Kintsch, 1974) include knowledge that guide the formulation of text structure, whether reading or composing a text. Text schemata information can be extracted from a text, in the process of reading and text comprehension, drawing on knowledge of norms or expectations. Or it can be integrated into a text, in the process of text production, drawing on procedural knowledge (Georgakopoulou & Goutsos, 1997; Piolat et al., 1999).

According to the Argument Schema Theory (AST) (Anderson et al., 2001; Graham & Harris, 2009), an argument schema is defined as a mental representation that encompasses goals and strategies for retrieval, invention and organisation of relevant to the argument information, objection anticipation, and identification of flaws in arguments. An argument schema can be broken down into argument stratagems, a kind of rhetorical or reasoning move of which the purpose, the condition of use, the form and consequence should be known to the arguer (Graham & Harris, 2009; Nussbaum & Edwards, 2011). The concept that supporting arguments, counterarguments and refutations are components of argumentation is an

argumentation schema on its own, which underpins the organisation of higher order argumentation processes (Piolat et al., 1999).

Different schemata may apply depending on the aspect taken in viewing the structure of a text and the goal of the arguer. Hayes (1996) stresses the role of genre-specific schemata in setting goals and sub goals to guide writing. A possible source of poor argument development is that the arguer has a poor argument schema, and therefore she is lacking in awareness of the requirements and processes, such as the need to generate sub goals (Flower & Hayes, 1981a; Victori, 1999; Wolfe & Britt, 2008). One argumentative schema, for example, would motivate an arguer to reflect on evidence that counters her position and possibly try to refute it, while another schema would discourage the arguer from providing counter information for fear of weakening own position.

Central in the conceptual approach taken in this thesis is a range of argumentation schemata that depend on the ability to critically assess and integrate arguments and counterarguments in an overall position. This ability is widely appreciated as part of writing argumentative essays (Coirier, 1996; Graham & Harris, 2009; Nussbaum, 2008; Piolat et al., 1999; van Eemeren & Grootendorst, 1994b). Nussbaum and his colleagues have highlighted the importance of overcoming myside bias approaches and proposed an *'argument-counterargument integration'* schema for defining well-developed argumentation (Nussbaum & Edwards, 2011; Nussbaum & Schraw, 2007). A number of studies were conducted to investigate the instruction of argumentation schemata, employing argument diagramming (Nussbaum, 2008; Nussbaum, Winsor, Aqui, & Poliquin, 2007). From these and other relevant studies it is possible to identify four argumentation schemata and corresponding integration strategies. The first two, the *myside bias* and the *pseudo-integration* do not integrate at all– or integrate very little – counter arguments in the formulation of a position. The third, the *integration*

schema, includes extensively counterarguments, as well as refutation and weighing strategies (i.e. compare arguments with counter arguments and draw conclusions). The fourth schema, the *synthesis*, is an advanced integration schema that consolidates different views in a compromise position, employing weighing, refutation and other rhetorical strategies. These four argumentation schemata are discussed in more detail in the sections below.

2.2.1 The myside bias argumentation schema

The term 'myside bias' is attributed to Perkins and his colleagues (1985; 1991) and refers to arguers who tend to support the position they favour more, even if they encounter arguments supporting the opposing position. Writers who tend to exclude or ignore information that does not support their own position implement the myside bias argumentation schema (Wolfe & Britt, 2008; Wolfe et al., 2009). Not inventing counterarguments because it is difficult to disengage from a strongly held claim or position is considered representative of myside bias argumentation schema. Similarly, considering counterarguments during planning but excluding them from the text can be safely taken as a myside bias schema.

2.2.2 The pseudo-integration argumentation schema

Nussbaum (2007) introduced pseudo-integration that characterises those struggling to deliver integration strategies, despite the presence of counter arguments. In particular, in *pseudo-integration*, the writer includes counterarguments in the development of the essay, may present the supporting and opposing side of an issue but formulates a position based on what he or she 'feels' strongly about (Nussbaum et al., 2007). The writer usually concludes without addressing already raised counterarguments that are either ignored or silenced. Conversely the writer emphasises the importance of some supporting arguments by restating them in the

conclusion or amplifying them with further examples or explanations of consequence (Nussbaum, 2008).

2.2.3 The integration argumentation schema

This schema includes extensively counterarguments, as well as refutation and weighing strategies:

- A *weighing* strategy considers both arguments and counterarguments and formulates an opinion on the basis that supporting arguments outweigh counterarguments. Emphasizing the strength of supporting arguments and minimizing the importance of counterarguments may also be applied.
- A *refutation strategy* rebuts a counterargument by showing that the counterargument is irrelevant or faulty. According to Nussbaum (2008), this is the least integrative strategy because, although the arguer examines arguments from both sides, she does so to defend only one of them (Graham & Harris, 2009). However, it is also suggested that if the refutation strategy is used together with the weighing strategy, the refutation strategy would not weaken the integrative quality of the approach (Nussbaum, 2008).

In contrast to the previous two argumentation schemata, the integration schema manages to integrate the arguments, the counter-arguments and the refutations in a final (concluding) position.

2.2.4 The synthesis argumentation schema

A synthesis argumentation schema is an ‘advanced’ integration schema where arguments and counter-arguments, as well as weighing and refutation strategies are used and arguments of

both sides are integrated into a compromise position. This compromise can be achieved in more than one ways:

- by adopting both positions and defining under what conditions the writer would adopt them and in what preference (Graham & Harris, 2009);
- by creating a course of action that bypasses a problem, applicable when a practical, action-oriented issue is addressed (Nussbaum & Edwards, 2011).

Argumentation schemata are important in the instruction and evaluation of argumentative writing. A weak or an inadequate argumentation schema is commonly related to the difficulties and weaknesses writers experience while composing argumentative text (McCormick, 2003; Nussbaum, 2008; Piolat et al., 1999; Wolfe & Britt, 2008; Wolfe et al., 2009).

2.2.5 Semantic and rhetorical argumentation structure

Argumentation schemata are considered to be the motivation, or even the driving force, of generating argumentation structure (Piolat et al., 1999). Embedded in a text, argumentation structure can be seen from various levels or perspectives. The distinction between macrostructure and microstructure in text is according to van Dijk a ‘global-local’ relation (1980, 1985). Macrostructures organise the ‘local’ microstructures. The term *superstructure* (van Dijk, 1980, 1985) describes a schematic organizational pattern that orders other structures, and has own categories, e.g. introduction-main-conclusion, and formulation rules, depending on the discipline. A superstructure pertains to the global ‘form’ of the discourse for which notions such as ‘outline, construction, order and build up’ may be used. It is complementary to the notion of macrostructure, which refers to semantic global structures

(van Dijk, 1985, p 3). While the global-local relation contributes to the definition of meaning the superstructure integrates rhetorical structure goals (Adam, 1992; Piolat et al., 1999).

While van Dijk's levels of structure are generic to all texts, a relevant distinction is needed for conceptualising aspects of argumentation structure. A relevant differentiation for analysing argumentation structure is the distinction between semantic and rhetorical argumentation structures. In general, the semantic structure refers to how ideas of an argumentative text are related to each other and to a main position or claim. The rhetorical structure refers to how ideas, meanings, or arguments are effectively communicated or textually presented.

Semantic structure of argumentation is understood in this thesis as the product of creating network of associations between ideas, arguments and positions. These associations are the result of activating schemata, such as those of integrating arguments with counter arguments (Nussbaum & Edwards, 2011; Nussbaum & Schraw, 2007). The semantic structure aims to communicate meanings that intend to stay with the reader. Semantic structure allows people to infer the 'gist' of a text or a debate (van Dijk, 1980).

Rhetorical argumentation structure deals with the aspects of linearity, hierarchy and order in argumentative discourse. These are important aspects in rendering a text suitable for an audience and delivering the formal organization of the text (Adam, 1992). A text that is suitable for an audience is in general easy to follow; hence it should have a clear, flowing – possibly predictable– and logical structure. Arguments may be organised following either a thematic or an argument orientation organisation (Piolat et al., 1999). Aspects of coherence, flow, and relevance are important in conveying clear structure that effectively communicates the rhetorical goal of the writer.

In effect, the scaffolding of argumentative writing requires the development of skills related to both semantic and rhetorical structures. In other words the scaffolding of argumentative writing requires a good grasp of both processes of argumentation and writing. This section has looked into various aspects of the argumentation process, the next section turns to the argumentative writing cognition process in order to discuss the relevant issues.

2.3 Cognitive process in argumentative writing

2.3.1 Towards argumentative models of writing

The study of the production of argumentative texts draws on cognitive models of writing, which provided the first accounts of the elements and processes of writing. According to the two most influential frameworks (Bereiter & Scardamalia, 1987; Flower & Hayes, 1980) the recursive processes of planning, translating, and revising, as well as setting and monitoring rhetorical goals are central in the process of writing. The three major processes, planning, translating and revising are included in subsequent models of writing (Galbraith & Torrance, 1999; Hayes & Nash, 1996).

Planning encompasses idea generation, evaluation and selection of ideas and conceptual organization of ideas. During *translation*, ideas are organised in a sequence (linearized) and encoded linguistically using grammatically correct sentences, linguistic connectives and markers to denote the structure of the text. During *revising* the writer reviews and evaluates the generated text against the assignment requirements and her own goals. Revising can take place during any stage of composing not just at the end. Thus revising may apply to the mental structure of the text, the intermediate planning artefacts, as well as the content and structure of text drafts.

Flower and Hayes (1980) theorized that writers set top-level rhetorical goals for a writing task, generate sub goals, then retrieve and organize knowledge to satisfy these sub goals. Expert writers may return to the global level of planning to incorporate new ideas into their goals for the text and generate further goals (Flower & Hayes, 1980, 1981a). Bereiter and Scardamalia (1987) explained the generation of sub goals through the interplay between the content and the rhetorical problem spaces. In the content space the writer focuses on concepts and beliefs about the topic (What do I mean?), while in the rhetorical space the writer focuses on communicative issues (What do I say?). There is limited or no interplay between the two spaces (content and rhetoric) amongst novice writers (knowledge telling). Expert writers, on the other hand, set sub goals in the content space that sub-serve these rhetorical goals (knowledge transforming). Skilful writers are able to translate high-level goals into sub goals, while novice writers have not developed the strategies for doing so or lack the knowledge of doing it successfully (Bereiter & Scardamalia, 1987; Flower & Hayes, 1980).

Moreover, the cognitive models of writing do not elaborate sufficiently on the interplay between rhetorical goals, context, and their realisation in writing (Coirier, Andriessen, & Chanquoy, 1999). Klein (1999) critiques cognitive models for not elaborating on how rhetorical goals are successfully transformed into content sub goals. Forming a position about a topic may motivate the interplay between rhetorical and content space however the actual process varies between writers. According to Klein:

> An illustration of this problem is Bereiter and Scardamalia's (1989) proposal that the rhetorical goal of persuading a reader, would lead a writer to search for evidence, and if it is lacking, to change her belief. Instead, it is possible that a writer would meet this rhetorical goal by setting other sub goals that would not transform her knowledge. For example, she could focus on favourable evidence and ignore counter-evidence,

fabricate support, appeal to prejudices or misconceptions, rely on a fallacy such as the ad hominem argument, or appeal to authority (Klein, 1999, p.250).

2.3.2 Planning strategies in writing

Kellogg specifies three types of prewriting strategies (Kellogg, 1994)

1. Clustering or networking ideas and their relations. This strategy is seen mainly as a visualisation of ideas in a nodes network, used for example during a brainstorming session. It may represent functional relations between ideas but not in hierarchical structure or linear organisation.
2. Listing ideas denotes the linear organisation of the ideas in the text, though in a flexible way.
3. Outlining ideas and their hierarchical relations seems to combine the two previous categories. Kellogg posits that outlining should provide both hierarchical structure, such as superordinate and subordinate relations, as well as linear organisation.

The first type of Kellogg's writing plans is relevant to the conceptual space of content generation, where relations between ideas are organised. The second type and third type are relevant to realising rhetorical goals. Sharples (1999) defines a similar spectrum of plan types ranging from rough notes and sketches, on one end, to the draft of the text, on the other. Sharples postulates that "No single type of representation can show both the associativity of ideas and the linearity of text" (Sharples, 1999, p.75).

Several studies have shown that when comparing outlining to other types of planning, such as clusters, networks and lists, outlining seems to have a greater impact on the quality of the text. Among these studies, Kellogg's studies (1988, 1990, 1994) provide strong evidence that outlining works better than a cluster and a list. Kellogg (1994) also found that outlining and

productivity -measured in terms of published work- correlated positively among science and engineering faculty.

Piolat (1999) found that few students use outlines when it is suggested but not required from them to plan. No diagram or other type of network type of planning was used, when students are asked to plan as they would normally do. Investigating argumentative writing, she also found that very few students used an organised draft or plan that has a linear format, e.g. lists, numbering arrows, indentations and indexing. Andrews (1995) also found that very few students would opt for a graphic form of planning requiring to think 'by conflict', i.e. to list the pros and cons of a topic. Torrance, Thomas, and Robinson (1991) investigated planning in the context of exam questions and found out that only four out of the 56 plans had a non-linear structure; however those engaged in outlining produce essays with higher marks.

Piolat (1999) attributes the success of outlining to familiarity with the specific strategy. The graphic mode is thought as a more uncommon way to organise a text. She states though that we should not dismiss the graphic form of planning altogether. Isnard and Piolat (1994)found that outlining work better in argumentative writing than ideas networks. However, using outlines is believed to contribute to the presentation of the text rather than re-construction of meaning (Kellogg, 1994; Piolat et al., 1999).

Disadvantages regarding the use of outlining are also reported. Outline requires production of ideas in the order they would appear in text as well as in a reasoned manner during the early stages of writing. This may stifle productivity (Kellogg, 1994; Sharples, 1999) as the writer assigns importance to the text as final product rather than the process leading to the construction of the meanings. Torrance, Thomas, and Robinson (1991) found no gain of planning on the quality of exam questions in a study where most of the participants used plan of linear structure. They concluded that the simple advice to plan in exam questions may not

be appropriate. Instead of just advising to plan, more writers should be advised on how to plan; for instance simply taking notes as a planning strategy yielded the poorest results. Hayes and Nash (1996) concluded that it is useless to push writers to plan more without teaching them how to plan effectively. Novice writers, especially, may need more guidance in this direction.

Kozma (Kozma, 1991), Scardamalia and Bereiter (1985), Bereiter and Scardamalia (Bereiter & Scardamalia, 1987) and Schriver (1988) found a positive impact of teaching planning strategies on the quality of planning but not necessarily on the quality of the final text. The problem could lie with the linearization or the translation process. Dellerman, Coirier and Marchand (1996) found that argument relationship planning had a significant effect on the texts produced. The effect of planning was noticed in lack of repetitions and the inter-argument relations, leading to more succinct essays.

The on-going debate over the usefulness of planning relies on certain assumptions. One assumption lies with the finding that inexperienced writers rarely plan, or plan less than experienced ones (Bereiter & Scardamalia, 1987). Less experienced writers often discount the value of planning and start immediately with processing text (Flower & Hayes, 1981a, 1981b). Even when they engage in planning, novice writers tend to be limited to a brainstorming type of planning, i.e. short, without associating or developing ideas (Hayes, 1996; Stotsky, 1990).

Another assumption about the usefulness of planning is on application and management of planning strategies. Prewriting strategies restructure attention to the various demands of writing in a way that attention overload may be alleviated (Kellogg, 1994). Planning ideas prior to writing provides a space for exploring relations between ideas before translating them into text and having to engage with linguistic demands. More experience writers make

sensible judgements about what planning method to follow or how long should spend in applying it (Hayes, 1996).

2.3.3 Interaction between planning and writing

The argument in favour of planning prior to writing is often countered by the argument that the process of writing is not linear (Hayes-Roth & Hayes-Roth, 1979; Hayes, 1996). Planning does not necessarily take place at the beginning of the writing process. The planning, translating and revising processes interact extensively so that they could almost merge during editing the first draft of the text (de Beaugrande, 1984). According to Torrance (1996) most students produce their drafts directly, namely they proceed directly to sentence generation.

However, there are indications that separating the two phases may help with managing the cognitive load imposed by the requirements of individual levels (Andriessen, Coirier, Roos, Passerault, & Bert-Erboul, 1996; Andriessen, de Smedt, & Zock, 1996; deBernardi & Antolini, 1996). Explicit division between idea organization and linearisation leads to improved quality of the argumentative text (Coirier et al., 1999).

Kellogg (1994) believes that even if all processes are invoked during the first draft, more effective planning takes place when a prewriting strategy is adopted than when it is not. Writers who prepare their essays by producing an organised draft write more effectively than those who prepare little or not at all (Piolat, 1999; Piolat et al., 1999). The basic assumption underlying research in the effects of prewriting strategies is that writing is more effective if the writer spreads sub processes, such as generating ideas structuring the text and translating, across different phases of the writing process. Sharples (1999) and Piolat (1999; 1999) agree that time spent on planning is time well spent and writers usually make good judgements about how to allocate their time between process of writing.

The difficulty of writing argumentative text lies with translating a spatial arrangement into a linear one (Coirier et al., 1999). In practice, separating the conceptual planning (invention) from the linearization and linguistic coding could be done by adopting planning strategies that support the conceptual planning prior to linearizing. Postponing the linguistic elaboration of texts until after conceptual planning and arrangement of arguments may allow a more focused deployment of linguistic skills on structural elements such as subordination, coordination and concession. However, this strategy would be useful to a writer who revises in the end rather than someone who polishes one sentence, paragraph or section before moving to the next (Chandler, 1995; Sharples, 1999).

The models presented here assume a 'backward search' hypothesis, whereby a writer sets rhetorical goals and subgoals and then, motivated them, transforms knowledge and produces text that responds to these goals. There are other hypotheses though (Galbraith, 1996; Klein, 1999). That writers generate knowledge at the 'point of utterance' following a spontaneous generation of content. The forward search hypothesis claims that writers express their ideas in text, then review this text, and make new inferences and knowledge associations. The conceptualisation of planning as prewriting strategy is misunderstood if it is claimed that planning always precedes and should precede writing. Whether spontaneously generate text, following or not specific rhetorical goals, writers often interleave writing to return to planning, i.e. set new gaols or revaluate existing test drawing on a textual schema.

2.3.4 Argumentative writing process

Systematic analysis of argumentation process dates as early as Roman rhetoric. In Cicero's manuals on oratory (Cicero, 1942 ed., 1954 ed.) there are five levels in speech production: a) invention, b) arrangement, c) linguistic formulation, d) memory and e) delivery. The first level or stage in Roman rhetoric, invention ('inventio'), refers to the mental process of finding

and investigating pertinent arguments. In this stage, classic rhetoricians were concerned with ‘topoi’, the semantic locations of arguments, which can be principles, rules of thump or legal frameworks. The second level, arrangement (‘dispositio’), is the arrangement of ideas, or parts of the discourse for presentation; hence it involves decisions about the order of presenting arguments. The profile of the audience and the application of persuasion tactics contribute to these decisions. The third level, linguistic formulation or style (‘elocutio’), is the level where words and phrases are finalised and refined. The fourth and fifth level of speech preparation, the memorisation and delivery of speech are less significant as far as argumentative structure is concerned.

In modern times argumentative writing research has defined four interrelated processes (Andriessen, Coirier et al., 1996; Coirier, 1996; Coirier et al., 1999):

1. *the reasoning process,* that is, the computation of logical relations between pieces of information, e.g. causal relation. Complex reasoning takes into account the relative importance of arguments (Coirier, 1996)

2. *the argumentative process*, consisting of choosing the best hierarchical organisation of argumentative information, taking into account the orientation (for or against the main position) of arguments, managing the discourse polyphony, and integrating the author’s ‘enunciative endorsement’ (Coirier et al., 1999)

3. *the linearization process*, where the writer combines pro- and counterarguments in a sequence, and integrates a hierarchy of themes and subthemes into a coherent thematic continuity (Andriessen, Coirier et al., 1996; Coirier et al., 1999)

4. *the linguistic coding process*, that is expressing with means of linguistic tools (connectives, embedding), the structure which has been build up (Andriessen & Coirier, 1999 p. 19).

There have been several attempts to investigate the difficulties involved in various processes during the production of argumentative texts (Andriessen, Coirier et al., 1996; deBernardi & Antolini, 1996; Isnard & Piolat, 1994). Voss, Green, Post, and Penner (1983) have pointed out problems resulting from the vagueness of argumentative domains (Voss, Greene, Post, & Penner, 1983); vague ideas and ill-structured arguments cannot be expressed effectively even if there is great linguistic ability. And vice versa, defining ideas and their interrelationships requires sophisticated linguistic skills. The transition from a dialogue to a monologue, including also the integration of polyphony in argumentative texts is also one of the most basic challenges in producing argumentative text (Golder & Coirier, 1994; Piolat, 1999; Piolat et al., 1999). Planning, linearizing and linguistic encoding relies closely on the writer's mental organisation, particularly with regards to the ability of structuring coherently the argumentative domains such as ideas, opinions and beliefs.

2.4 Metacognition in writing

It is possible to approach writing cognition from two perspectives. Firstly, the actual *cognitive process and strategies* that can be inferred through observing the writer on task and analysing intermediate and final products, such as plans or drafts and final texts. Secondly, the *metacognitive awareness* about the processes and strategies that are involved in planning, linearizing and writing. This can be explored by eliciting the writer's own awareness about processes and strategies involved in constructing intermediate and final products of writing.

Metacognitive knowledge is positively correlated with the quality of text in many studies (see Harris et al., 2010 for a review). This is evidenced by findings showing that experienced writers are more knowledgeable than novice writers about the process they engage in when writing (Englert et al., 1992; Graham & Harris, 2009; Lin et al., 2007). Novice writers are less knowledgeable as to what successful writing process and good written products are

(Raphael et al., 1989). More interestingly, writing instruction that increases the writer's knowledge about the high order processes and text qualities also improves the outcome of the writing process (Bereiter & Scardamalia, 1987; Saddler & Graham, 2007).

Metacognition regarding the writing skill is defined by two main concepts: knowledge about cognition and ability to monitor cognitive activities (McCormick, 2003; Raphael et al., 1989; Sitko, 1998). The first component, namely knowledge about cognition, is widely conceptualised by three main components. Firstly, *declarative knowledge* refers to what the writer knows about *what* processes are involved in writing, what constraints and conventions are required by different genres, and own strengths and weakness in composing text in these genres. For example, the knowledge that integration of arguments and counterarguments is highly valued in argumentative writing. Secondly, *procedural knowledge* refers to *how* a writer successfully executes a process, deals with constraints of different genres, and what effective strategies she employs. For example, in order to successfully integrate information that counters a central claim the writer needs, amongst others, to establish a clear argument structure mentally or graphically and use linguistic signifiers for clearly expressing it in the text. Thirdly, *conditional knowledge* helps the writer to determine *when* the appropriate processes should be evoked given the task requirements or genre constraints. For example, a writer is likely to call upon a debate structure when she engages in academic writing, while she is likely to recall a linear or chronological structure when writing a technical report.

The second component of metacognition refers to the ability to monitor and regulate cognitive processes and relevant strategies. Schraw and Dennison (2007 p.474) include a range of skills and strategies in metacognitive awareness in learning: 'planning', for example how one sets goals and allocates resources prior to learning, 'information management', namely how to efficiently organise or elaborate information, 'monitoring', i.e. assessment of one's learning

strategy use, and 'evaluation', analysis of performance and strategy effectiveness after a learning episode. In other words these are further skills and strategies required so that the writer can implement the evoked knowledge about argumentation schemata and strategies. While writers are monitoring or regulating their implementation, they may discover limitations to their strategies and acquire further skills. In Zimmerman's words:

> Like Hayes and Flower, Bereiter and Scardamalia describe self-regulatory strategies as mental subroutines for enhancing writing performance; however, they suggest that these strategies also contribute to the development of one's cognitive system by enabling the personal discovery of new linguistic rules. Thus, cognitive self-regulatory strategies are viewed as essential for explaining how writers can acquire greater skill from their own writing efforts (Zimmerman, 1997 p.75).

A number of studies investigate the impact of a range of instructional methods on writer's metacognition (Harris et al., 2010; McCormick, 2003). Receiving instruction on text structure is found to increase the sense of how to present and organize information (Raphael et al., 1989). Conner (2007) found that students who gain high awareness of strategies to plan and monitor their work and practiced these strategies write essays of good quality. Problems related to argumentative text structure seemed to improve as result of the teacher's awareness raising activity, namely commenting on students drafts (Igland, 2009). A wide body of empirical studies shows that Self-Regulated Strategy Development (SRSD) improves the quality of students' argumentative writing and reports that it increases young writers' knowledge of how to plan and what constitutes good writing (Graham & Harris, 2009; Graham, Harris, & Mason, 2005; Harris, Graham, & Mason, 2006). SRSD methods include explicit instructions for writing, specific procedures for planning and revising, goal-setting procedures and self-monitoring skills. However, only one study investigates the impact of

argument diagramming on writer's metacognition (Yeh, 1998a). In a study where argument mapping is used to organize arguments prior to writing, the emphasis is on perceived effectiveness of the tool on critical thinking skills rather than argumentative writing process (Carrington, Chen, Davies, Kaur, & Neville, 2011). Felton and Herko (2004) argue that metacognition of argumentative writing strategies is improved with the use of graphic organizers: "By using graphic organizers we help students become aware of their implicit knowledge about argument structure"(p.682).

2.5 Argument diagramming

2.5.1 Instructional perspectives in argumentation

A number of methods have been developed to instruct argumentative writing, for example reading and analysing argumentative texts, collaborative discussion in the classroom, explicit teaching of rhetorical goals; see Newell, Beach, Smith, & Van Der Heide (2011) for a review on argumentative writing instruction methods. According to two meta-analyses, interventions that involved writing strategies instruction and prewriting activities were more effective (Graham & Perin, 2007; Rogers & Graham, 2008).

Furthermore, over the past two decades the area of computer-supported argumentation has been growing rapidly with research studies involving computer-supported argument visualisation (Andriessen et al., 2003; Kirschner et al., 2003; Okada et al., 2008; van Gelder, 2001, 2003). Two comprehensive reviews (Noroozi et al., 2012; Scheurer et al., 2010) drawing jointly on more than 150 papers, report on a plethora of computer-supported argumentation tools and diverse empirical studies. Some adopt argument diagram representations, while others use procedural scaffolding with scripts, or general purpose systems such as e-mail, chat, and content management platforms. These tools are used

primarily for knowledge representation and for structuring discussions, mainly as part of collaborative argumentation. The impact is measured with regards to managing discussion, sustaining collaboration, and improving reasoning skills, in particular causal, legal and historical reasoning.

In the context of the studies mentioned above, research on planning in argumentative writing is – and should be – examined in the context of the particular demands of the argumentative genre and the instructional needs in argumentative writing (Andriessen, Coirier et al., 1996; Coirier et al., 1999; Dellerman et al., 1996; Isnard & Piolat, 1994; Piolat et al., 1999; Yeh, 1998a). Depending on the demands of the writing task, the writer may call upon specific textual superstructures, schemas, particular semantic constituents, and linguistic means (Alamargot & Chanquoy, 2001). Making an ideas network or a list does not necessarily guide the rhetorical structure of argumentation unless a good use of the planning method is instructed and learnt (Hayes, 1996; Sharples, 1999). Concept mapping may help students to establish relations between ideas but do not specifically envisage position taking, argument direction and balanced development.

Research that investigates planning strategies within the argumentative genre is more limited than research investigating planning strategies in general. There are only a few studies that explore the function and effectiveness of planning with regards to the specific demands of argumentative writing (Andriessen, Coirier et al., 1996; Coirier et al., 1999; Dellerman et al., 1996; Isnard & Piolat, 1994; Piolat et al., 1999; Yeh, 1998a). A prominent method amongst the instructional approaches to argumentative writing is the method of argument diagramming. Some studies examined the *impact of argument diagrams on argumentative essays* (Lin et al., 2004; Nussbaum, 2008; Nussbaum & Schraw, 2007; Okada, 2008; Suthers et al., 1997; Yeh, 1998a). Argument diagramming, as a prewriting strategy, has shown

promising results. Its value is seen in many facets: in scaffolding the writer in planning, linearizing and revising argumentation structure; in facilitating the management of cognitive load involved in generating complex argumentation structure; in activating or strengthening knowledge of argumentation schemata. The roots, development, and impact of argument diagramming are presented in the following sections.

2.5.2 Theoretical underpinning of argument diagramming

Argument schemata are often conceptualised and represented as mental structures with elements such as supporting claims, counterarguments and refutation represented by graph slots or diagram components (McCormick, 2003; Toulmin et al., 1984). The theoretical underpinning of the rapidly growing area of argument diagramming draws on the area of external representation and external cognition (Scaife & Rogers, 1996; Stenning et al., 1995).

External representations imply the process of externalising internal (called also mental) structures, i.e. the knowledge structures in people's minds (Rumelhart & Norman, 1988). External representation is a term used widely (Cox & Brna, 1995; Neuwirth & Kaufer, 1989; Scaife & Rogers, 1996; Toth, Suthers, & Lesgold, 2002; Zhang, 2000) and refers to both linguistic and graphical forms. According to Zhang:

> External representations are the knowledge structures in the environment, as physical symbols, objects or dimensions (e.g., written symbols, beads of abacuses, dimensions of a graph, etc.), and as external rules, constraints or relations embedded in physical configurations (e.g. spatial relations of written digits, visual and spatial layout of diagrams, physical constraints in abacuses, etc.) (Zhang, 2000, p 165).

Constraints underlie the expressiveness of an external representation. "A good representation system captures exactly the features of a problem rather than representing everything.

Reasoning with an abstract representation of a situation can be much more effective than reasoning with a concrete situation alone" (McKendree, Small, & Stenning, 2002, p 60). Constraints comprise the logical and semantic features (Suthers, 2003; Suthers & Hundhausen, 2003) that result from ontological decisions.

Salience is a feature of interpreting and processing an external representation while constraints are a feature of the representation itself (Larkin & Simon, 1987; Neuwirth & Kaufer, 1989; Suthers & Hundhausen, 2001). Argument diagrams make argument relations salient, visualise the balance between arguments, counterarguments and refutations. Thus, they provide an overview to how arguments interlink and contribute to the formulation of a position. The visualisation of argument components on diagrams and the interaction with them is believed to 'activate, strengthen, and refine the existing schemata or help to develop new ones' (Nussbaum & Schraw, 2007, p.65).

The framework of cognitive dimensions (Blackwell, Britton, Cox, & Green, 2001; Green, 1989) has been used to describe properties of argument diagrams used in representing design rationale (Shum, 1991) and ideas sketches (Wood, 1993). *Premature commitment* refers to a property of the argument diagram to suggest or impose the order of doing things. For example, entering a lower level node comes after entering a higher level node. *Viscosity* defines the flexibility of an argument diagram to be easily revised as the underlying reasoning changes or evolves. The *hidden dependencies* dimension applies when semantic associations between elements are concealed. The *role expressiveness* dimension refers to how well the purpose of a diagram element or a whole diagram structure is communicated. It also refers to the decision to include a more or less rich set of diagram elements to constraint the expression of specific argumentation components. Other dimensions are also the *visibility*, the ability to

view components easily and the *closeness of mapping* which refers to how close to the domain of representation the notation really is.

Interacting with external representations, such as argument diagrams, and their many properties and dimensions, involves a comparison and contrasting of internal and external representations. This may lead to cognitive benefits, depending on the properties of external structures, the level and the complexities of internal ones, and the quality of the in-between dialogue. According to Kuhn (2002), learning is facilitated when a subject (writer in the case of writing) has the chance to reflect on the difference between what she thinks is true and the information coming from external representations which verify or shed doubt to these beliefs. The process of confronting external representations that are not compatible with the internal beliefs and representations have demonstrated the biggest potential for learning and change (Bernas & Stein, 2001, p. 180). Vosniadou & Verschaffel (2004) point out that this confrontation process allows for inconsistencies in current internal representations to become evident and therefore gives the opportunity for new representations to be constructed. Interacting with external representations can also lead to metacognitive benefits involving the activation of awareness about the adequacy of internal structures (Kirsh, 2005).

2.5.3 Computer-supported argument diagramming

Computer-supported planning of writing

Computer-supported planning of writing is a category of writing environments in which planning strategies, such as outlining and note taking, are supported with computer-based tools (Bacig, Evans, & Larmouth, 1991; Erkens, Jaspers, (Tabachneck-)Schijf, & Prangsma, 2001; Haake & Wilson, 1992; Kozma, 1991). Along with the development of general models

of writing and research on prewriting strategies the area of computer-supported planning in writing has also become the focus of research (Kellogg, 1994; Sharples, 1996).

An interesting aspect of computer-supported planning is that it can integrate in the same computer environment multiple views or activity spaces, which may correspond to different conceptual spaces or schemata. These activity spaces support the writer across the processes of writing. Following this, these systems share activity spaces and functions like an ideas organiser, a network with text nodes, a structure editor (for accessing an overview of the text), a text editor, a chat facility and possibility to share the output of their planning with other users. The outline supports planning in the rhetoric conceptual space, the notes network supports planning in the semantic conceptual space. The need for alternative organisation of the material, such as topic structure (based on content) procedural structure, task structure, importance structure, had been raised in observational studies investigating the use of external representations (O' Malley, 1988). Those early systems that support writing were designed for all writing genres.

Early computer-supported writing systems

The SEPIA environment (Haake, Neuwirth, & Streitz, 1994; Haake & Wilson, 1992) included an activity space that is intended for organisation of argumentation structure only. The Writer's Assistant (Sharples, Goodlet, & Pemberton, 1992) implemented an algorithm for allowing an automated transition from a network of nodes to linearized text. The Writing Environment (Lansman, Smith, & Weber, 1993), a research tool for exploring composition processes, integrated a function for logging writers' processes. The software application used in the COSAR project (Erkens, Kanselaar, Prangsma, & Jaspers, 2002; Erkens, Prangsma, Jaspers, & Kanselaar, 2002), a project studying collaborative writing of argumentative texts, integrated an argument diagram and a chat facility.

Another category of software applications, widely used for supporting writing, implements concept mapping. An example is Mindsets, which applied the concept of Mind Maps (Buzan & Buzan, 2006). The graphical representations created with Mindsets could be thought as 'intermediate representations' allowing a writer to visualise associations between mental concepts before committing to them in the final document. According to Jonassen (1998), when students are using Mindsets to represent what they know they engage in reflective, critical thinking about the ideas they are studying. Jonassen also suggested that employing software applications as knowledge representation formalisms facilitate meaning making more readily and more completely than the available computer-based instruction.

Diagram editors are often used as computer-supported scaffolding in composing argumentative text providing a network view, where users can semantically plan their arguments, or an outline view where users organize the rhetorical structure of their arguments (Diehl et al., 2001; Kozma, 1991; Streitz et al., 1989). However, the employed graphic representations do not adopt a formal or semi-formal representation of argumentation structure as argument mapping diagrams (Nussbaum, 2008; Yeh, 1998a) or computer-supported argument mapping do (Suthers et al., 1997; van Gelder, 2003).

Collaborative learning and argumentation

Collaboratively structuring argumentation, drawing on negotiating the construction of knowledge through dialogue, has been a growing research area. From a constructivist perspective, collaborative argumentation encourages the participants to externalise their knowledge and opinions, improve their explanation skills, reflect on each other's information and construct or reconstruct knowledge (Kanselaar et al., 2003). There are many projects involving collaborative structuring of argumentation (Andriessen et al., 2003; Erkens, Kanselaar et al., 2002; Erkens, Prangsma et al., 2002; Hirsch, 2004; Veerman & Treasure-

Jones, 1996). The presence of two or many arguers encourages the realisation of communicative goals in argumentation creating a space where arguers reflect with other people rather than reflecting with themselves only. Anticipating opposing views and arguments, as requirement of good argumentation, both written and spoken, may become explicit during collaborative argumentation (Andriessen et al., 2003).

Most of these studies deploy a collaborative planning phase where writers interact in dyads, triads or more before they are asked to write an argumentative essay individually. Although dialogical thinking is encouraged in the context of collaborative argumentation, the abilities and strategies of individual writers are obscured by the group dynamics, with a clear footprint of the group knowledge on the planning cognition process. However, very often writers are expected to produce an argumentative essay without access to a collaborative group; individual writers need to develop their own dialogical thinking schema. It is not yet clear if the dialogical schema exhibited during collaboration is transferred to the written text (Gillies & Khan, 2009; Newell et al., 2011) this casts doubts on the extent to which the knowledge about argumentation, accessed in the group, is transferred when the writer works on her own.

Computer-supported argument diagramming for argumentative essays

Many computer systems are implemented to support the representation of argument structures and facilitate the management of argumentative interaction. A computer system that supports the formulation of argumentation usually consists of a diagram editor, which helps in manipulating a notation, and functions, which allow the user to interact with the notations. Another characteristic of such systems is that they enable the display of a controversy – often defined as scientific controversy – from multiple perspectives and their common scope is to assist individuals (or small groups of students) in analysing evidence and visualizing the relationships between theories and evidence.

In some studies (Erkens et al., 2005; Lin et al., 2004; Okada, 2008; Rider & Thomason, 2008) the use of argument diagramming is instructed as a pre-writing strategy. In a few cases argument diagramming also supports writers to translate the argument structure into text with an outline (Benetos & Schneider, 2011; Erkens et al., 2005; Sbarski, van Gelder, Marriott, Prager, & Bulka, 2008). This supports them with responding to rhetorical structure goals, i.e. arranging arguments thematically and hierarchically.

Interaction and feedback from computer-supported diagram editors

Most argument diagram editors provide functions for viewing the whole diagram or details of it, hiding or showing components (e.g. Athina: Rolf & Magnusson, 2003; Reason!Able: van Gelder, 2003), or for shifting between different argument structure dimensions, for example an ideas network and an outline (e.g. SEPIA: Streitz et al., 1989) or a list of links and associated text (Diehl et al., 2001). More sophisticated design may also allow expanding or collapsing a structure (e.g. Reason!Able van Gelder, 2003).

In a system supporting the formulation of argumentation structure, the arguer's task is to construct acceptable instances of the diagrammatic formalism which is represented in the system. The user interacts with the system, receives feedback from changes on the screen or from advice provided by the system (or Convince Me: Siegel, 1999; e.g. Belvedere Suthers et al., 1997). Receiving feedback on allowed (or not) combinations of diagram components should convey the semantics of the diagrammatic formalism. Tutoring on reconstructing or rectifying illegal moves by means of an anthropomorphic agent or pop up messages is sometimes provided by the system on specific actions or by request. Advice may also be given for improving the structure, for example how to make use of components.

Belvedere is system that supports feedback though an anthropomorphic agent (Suthers & Hundhausen, 2001; Suthers et al., 1997). The implemented advisor parses the diagram tree and accordingly gives advice. Reason!Able (van Gelder, 2003) provides general advice on request through an interface agent on how to construct the diagram, although the advice is not specifically related to the under construction diagram.

In some systems the supporting representation of argumentation structure, claims or propositions are assigned with values of truth, likelihood or acceptability (SEPIA: Haake & Wilson, 1992; Athena: Rolf & Magnusson, 2003; Convince Me: Siegel, 1999; Belvedere: Suthers et al., 1997; Reason!Able: van Gelder, 2003) This is sometimes visualised on the diagram, with, for example, different colour or thickness of lines. In most of these systems, subordinate nodes have connections to superior nodes of the kind support or attack or relevance. Thus, the subordinate node increases or decreases the acceptability (or relevance) of the superior node. However, in most of these systems, expect in the Convince Me (Ranney, Schank, & Diehl, 1996; Siegel, 1999), the value of the conclusion is not calculated according to the values assigned by the user. It is not estimated how assigning values affect the balance of the argumentation structure as it would in computational approaches to decision making (e.g. Bayesian networks of beliefs, probabilistic reasoning). Instead, 'the users will have to judge for themselves the added effects of subordinate premises to superior conclusions' (Rolf & Magnusson, 2003, pg.922).

In the Convince Me (Ranney et al., 1996; Siegel, 1999) programme, the feedback is provided on the basis of coherence of the student's argumentation. This is based on a correlation between the student's believability ratings for an argument's propositions and the simulation model's activations, i.e. a debate around a topic is modelled in the system.

The systems are usually designed on the basis of argument structure formalism but with limited possibilities to relate coherent and balanced argument structure with valid content. In other words the system cannot assess the content of the arguments, despite the fact they contribute to an acceptable instance of diagrammatic argument structure formalism. In one of the systems (Convince Me:Siegel, 1999), where the topic of argumentation is prepared in advance, a set of possible arguments may be already available to the system, like in an expert system. In this case, the users responses may be matched to the system's knowledge representation and the system may provide feedback on the content of the arguments too.

2.5.4 Computer and paper-based argument diagramming

Some studies examine the scaffolding of argumentative writing through *paper-based argument diagramming* (Nussbaum, 2008; Nussbaum & Schraw, 2007; Yeh, 1998a) while other studies look at *computer-based argument diagramming* (Erkens et al., 2005; Lin et al., 2004; Okada & Buckingham Shum, 2008; Suthers et al., 1997). Although both paper and computer-supported argument diagramming interventions are discussed it is not clear how the one relates to the other. The two discussion threads are largely kept apart except for a few exceptions (Erdogan, 2009; Lin et al., 2004; Sturm & Rankin-Erickson, 2002).

Lin et al. (2004) found contrary to their hypothesis that using paper-based concept mapping had a better effect on the quality of persuasive writing than using Inspiration, a computer-based concept mapping software. The students were instructed to use a graphic schema for organising the thesis, reasons, and examples of reasons. Counterarguments and refutations were not proposed as part of the graphic schema. The study also found that the quality of computer-based maps were higher than the paper-based in terms of amount of ideas produced, the quality of thesis statements and the relations between reasons and examples. The higher score of the paper-based concept mapping is attributed to a small increase on time attributed

to writing the essay. They found that working with the computer-based maps resulted to better concept maps in terms of amount of ideas produced, the quality of thesis statements and the relations between reasons and examples.

Exploring the impact of concept mapping on expository writing on middle school students with learning disabilities Sturm and Rankin-Erickson (2002) found no difference on the quality of essays but improved attitude towards writing when using computer-based concept mapping. Erdogan (2009) also found no difference between computer-based and paper-based effects of concept mapping on learning about computer hardware components and functions but a more favourable attitude towards working with the computer-based maps.

Harell (2005) reviewed five prominent software packages and maintained that the importance of argument diagramming skill should be seen irrespectively of the computer-paper medium. Harrell (2008) argues that teaching argument diagramming does not need to take place on a computer; argument diagramming can benefit substantially critical thinking on paper as well. She is very clear that there is no evidence in favour of either method:

> To my knowledge there has been no research to determine whether the crucial factor is the mere ability to construct argument maps, or the aid of a computer platform and tutor, or possibly both (Harrell, 2008 p.356)

A discussion is needed to identify the strengths and weaknesses of each medium, and how the affordances of each relate to the process and outcome of planning cognition. The rationale of using argument diagramming to support argument writing lies with providing a platform that mediates the writer's interaction with the writing processes. However, little is known about how the paper-based or a computer-based approach to argument diagramming affects the writer's interaction with the argumentative writing process.

2.5.5 Impact of argument diagramming on argumentative writing

Most of the systems implemented to support the representations of argument structures or facilitate the management of an argumentative interaction are not specifically designed to support the processes of argumentative writing. In fact there are only a few studies that examine the impact of argument diagramming on argumentative writing (Baker et al., 2007; Erkens et al., 2005; Kozma, 1991; Okada, 2008; Proske et al., in press).

Yeh's research (2002) is one of the few that clearly integrates an argumentation schema in planning writing to explicitly instruct argumentative writing. Yeh introduces two heuristics, one based on Toulmin's schema (Toulmin, 1958) and one on classical rhetoric mostly as a method of transferring knowledge about argumentation structure rather than a planning method. Explicitly teaching heuristics about the process of constructing arguments led to significant gains in the support and voice of essays written.

The impact of interventions, including collaborative and computer-supported planning, is measured in many cases in terms of overall assessment of text and argument structure (De La Paz, 2005; Graham, Macarthur, Schwartz, & Pagevoth, 1992; Nussbaum & Schraw, 2007; Okada, 2008; Troia & Graham, 2002; Yeh, 1998a) and less commonly in terms of the writing process (Erkens et al., 2005; Kozma, 1991; Okada, 2008; Proske et al., in press).

Studies in computer-supported collaborative argumentation that have investigated the process of argument diagramming focus mainly on the nature and function of the arguer's contributions during the collaborative construction of argument diagrams (Baker et al., 2007; De Vries, Lund, & Baker, 2002; van Amelsvoort, Andriessen, & Kanselaar, 2008). The rainbow framework of analysis introduced task focused activities such as 'opinion' 'explore/deepen' 'argumentation' 'task management' and non-task focused activities such

'management of interaction' and 'social relation ' (Baker et al., 2007, p.326). The framework has been employed in many studies (Munneke, Andriessen, Kanselaar, & Kirschner, 2007; van Amelsvoort et al., 2008; van Drie, van Boxtel, Jaspers, & Kanselaar, 2005) that explore the process of students who engage in computer-supported collaborative argumentation. Baker defines as goals of collaborative argumentation the 'broadening and deepening understanding of a space of debate' (Baker et al., 2007, p.322), whereby interaction encompasses a range of themes related to the same debate, as well as expression of justifications arguments and counterarguments. While this is one of the few frameworks of argumentative dialogue it does not specialise on more sophisticated aspects of argumentation.

The rationale of using argument diagramming to support argument writing lies with providing a platform that mediates the writer's interaction with the writing processes. However, we know very little about how the paper-based or a computer-based approach to argument diagramming affects the writer's interaction with the argumentative writing process. Furthermore, the impact is rarely measured in terms of writers' metacognitive awareness about writing strategies (Conner, 2007; Felton & Herko, 2004; Igland, 2009). Only one study is known to have explore the impact of collaborative diagramming as a planning method on metacognition (Erkens et al., 2005). Nevertheless, the importance of writing metacognition in writing instruction is well established (Harris et al., 2010).

In few words, despite the value of these studies, the evidence on this field is clearly insufficient and considerably more evidence is required to draw safe conclusions. More studies are required to explore issues such as 'what planning cognition processes are enhanced by the use of argument diagramming?', 'in what way does planning cognition changes feed into the quality of the essay?'

Chapter 3 Studies 1a & 1b: Impact of argument diagramming on quality of argumentative writing

3.1 Introduction

Argumentative writing refers to cognitive processes such as reasoning, planning, and translating (Coirier et al., 1999). It also refers to argumentation schemata that guide the organization of claims, reasons, counter positions in a coherent text structure (Wolfe & Britt, 2008; Wolfe et al., 2009), and to argument models (e.g. Toulmin, 1974; van Eemeren et al., 1996) which are believed to enrich the learner's argumentation schemata. The motivation in this strand of research is that instruction aiming to improve the writer's argumentation schemata will affect the quality of argumentative writing.

This can be done in many ways: for example, by instructing writers to formulate appropriate rhetorical goals (e.g. Ferretti et al., 2000; Nussbaum & Kardash, 2005); by reading and analysing argumentative texts (e.g. Kobayashi); by fostering collaborative argumentation (Suthers & Hundhausen, 2003; van Amelsvoort et al., 2008); and by argument diagramming (Nussbaum & Schraw, 2007; Okada & Buckingham Shum, 2008).

Argument diagramming is one of the prominent instructional approaches to scaffold argumentation. The majority of these instructional approaches rely on online discussions and knowledge representation (Scheurer et al., 2010). Argument diagramming has scarcely been used to support argumentative writing (Benetos & Schneider, 2011; Carrington et al., 2011; Erkens et al., 2005; Lin et al., 2004; Okada, 2008). Clearly, there is a need to build up this evidence and comprehend better whether and how argument diagramming scaffolds argumentative writing.

Most of the studies investigating the impact of argument diagramming on argumentative writing embark on holistic assessment of the produced essay, based on reader-focused scoring on a given set of criteria. However linguistic difficulties, digression and coherence issues can obscure the underlying effort of the writer to develop complex and sophisticated argument structures. Equally, aptitude in written discourse may (falsely) enhance the persuasiveness of argumentation. A few studies engage into exploring the argumentation aspect of the produced essays by employing analytic evaluation methods (Nussbaum, 2008; Nussbaum & Schraw, 2007). A combination of holistic (reader-based) and analytic (text-focused) evaluation approaches are needed to understand the precise impact of argument diagramming on the argumentation structure of essays (Kellogg, 1994; Reznitskaya, Kuo, Glina, & Anderson, 2009).

Argument diagrams to support argumentative writing have been used as a paper-based method (Nussbaum, 2008; Nussbaum & Schraw, 2007; Yeh, 1998a) or as a computer-based method (Benetos & Schneider, 2011; Carrington et al., 2011; Erkens et al., 2005; Lin et al., 2004; Okada, 2008). Although each strand of discussion has produced valuable insights, they are largely kept apart (Lin et al., 2004; Sturm & Rankin-Erickson, 2002).

In response to the identified limitations of existing research, this chapter addresses the following research questions:

RQ1a. Does argument diagramming administered as a computer-based method improve significantly the quality of argumentative essays?

RQ1b. Does argument diagramming administered as a paper-based method improve significantly the quality of argumentative essays?

Two hypotheses were developed to explore this research question:

Hypothesis 1a*: The use of computer-based Dialectic Method, as a method of supporting the planning and writing of argumentative essays, improves significantly (i) the overall quality and (ii) the argument structure of argumentative essays.*

Hypothesis 1b*: The use of paper-based Dialectic Method, as a method of supporting the planning and writing of argumentative essays, improves significantly (i) the overall quality and (ii) the argument structure of argumentative essays.*

Two exploratory studies were set up using a pretest/posttest design: study 1a explores the impact of computer-based argument diagramming and study 1b explores the impact of paper-based argument diagramming. The impact on argumentative text is measured with i) a holistic scale of argumentative essay quality and b) and an analysis of argument structure elements.

In order to explore these hypotheses the Dialectic Method (DM) was devised as a method of supporting argumentative writing using argument diagrams. The method can be administered as a computer-based method (Computer DM) and as a paper-based (Paper DM) in order to scaffold the planning of argumentative essay (Chryssafidou, 2000; Chryssafidou & Sharples, 2002).

The *computer-based Dialectic Method* (Computer DM) is applied with the support of the Dialectic diagram editor. The user introduces tentative positions, invents arguments, analyses them in statements, and defines semantic associations between them, thus building a diagram of interlinked arguments. The computer implementation affords functions which help to visualise argument structure components and relations (argument notation). It arranges diagram components in a symmetrical formation on which argument textboxes are coordinated or subordinated. The computer implementation also affords a colour coding function of the diagrammatic notation elements which facilitates the overview of the

argument orientation. That is, supporting arguments are coloured green, opposing are coloured pink, and refuting are coloured dark red, based on the user's definition of argument relations. The Dialectic diagram editor is presented in detail in Section 3.2.1. The *paper-based Dialectic Method* (Paper DM) is equivalent to the Computer DM in that the same notation and colour coding scheme is applied by the user on paper. The user is instructed to use the argument notation in the same way as in the Computer DM.

The study was conducted as part of a pre-sessional school for international undergraduate students with 21 participants.

This chapter will present analytically the procedures, method and the measures employed. The Method section gives a description of the design of the study, the setting where the evaluation took place, as well as the measures employed. The chapter then presents and discusses the results of the data analysis.

3.2 The Dialectic Method (DM) as a pre-writing method

Both the Computer DM and the Paper DM are used in deliberating over a position vis-à-vis a controversial issue and in formulating arguments. An essay question is given, which requires from the writer, first, to explore the different positions one can take towards an issue and, second, to take a position. DM comprises of:

- The Dialectic notation, a notation for representing elements of argument structure
- The Dialectic checklist, a set of prompting questions to motivate the development and reflection of argumentation structure components
- Basic advice on how to translate the diagrammatic representation of argumentation structure into an essay.

- The Dialectic notation can be drawn on paper, using a predefined set of argument comments, links and colour codes (Paper DM). In the computer DM the Dialectic notation is deployed using the Dialectic Diagram Editor.

3.2.1 Dialectic diagram editor

The Dialectic Diagram Editor provides a drawing space for the deployment of the Dialectic notation (Figure 3.1). It allows the user to draw elements of an argument notation, i.e. position and argument textboxes, enter text in the position and argument textboxes, and associate them with the two basic links of the notation, 'supports' and 'refutes'. The user can access the overview of the diagram, i.e. see the whole diagram on screen, as well as zoom in parts of it.

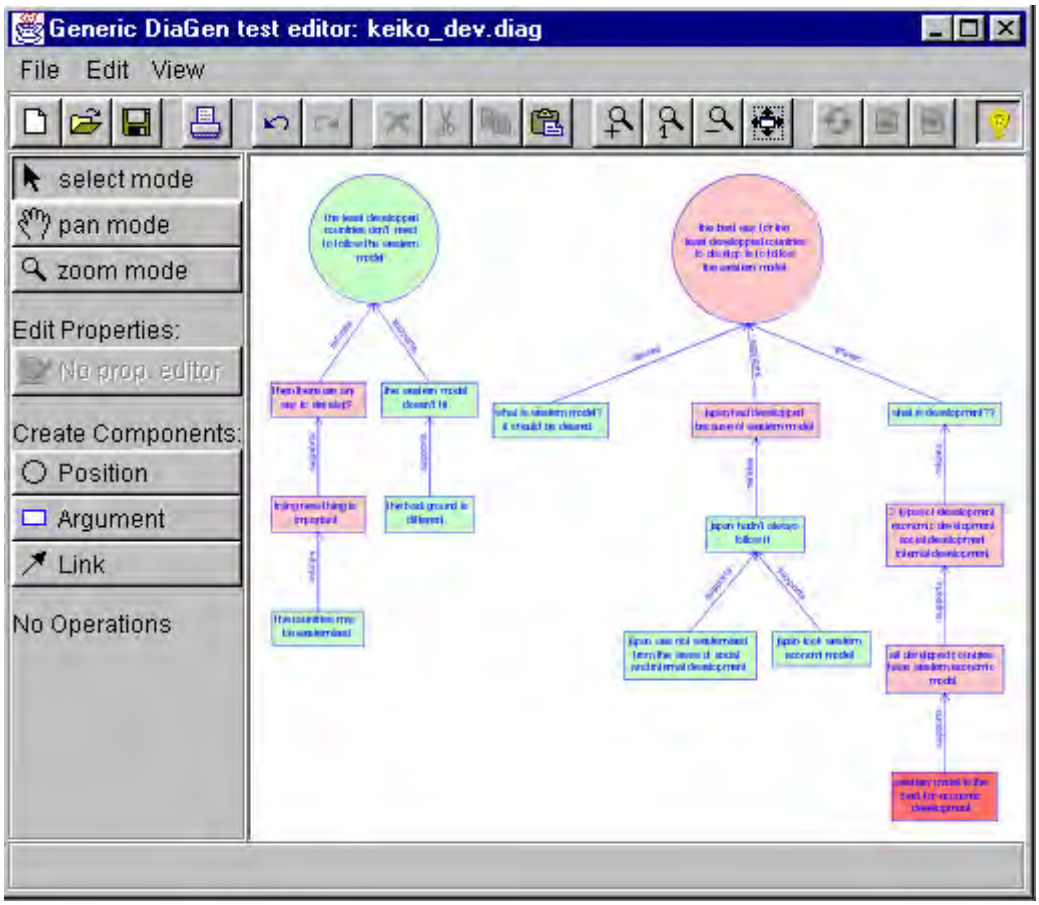


Figure 3.1: Screenshot of the Dialectic diagram editor with a developed diagram

The diagram editor is programmed to parse the diagram and detect 'legal' and 'illegal' combinations of diagram components (syntax parsing function). 'Legal' combinations of diagram elements and relations define the *grammar* of the notation formalism. They are the combinations of diagram components that are consistent with the given syntax of the dialectic notation. The Dialectic Diagram Editor provides visuals feedback to the users by indicating where they followed the syntax of the diagram elements correctly and where they have not. 'Legal' use of the notation, i.e. consistent with the underpinning argument structure notation, is coloured blue (Figure 3.2). Illegal use is coloured in black.

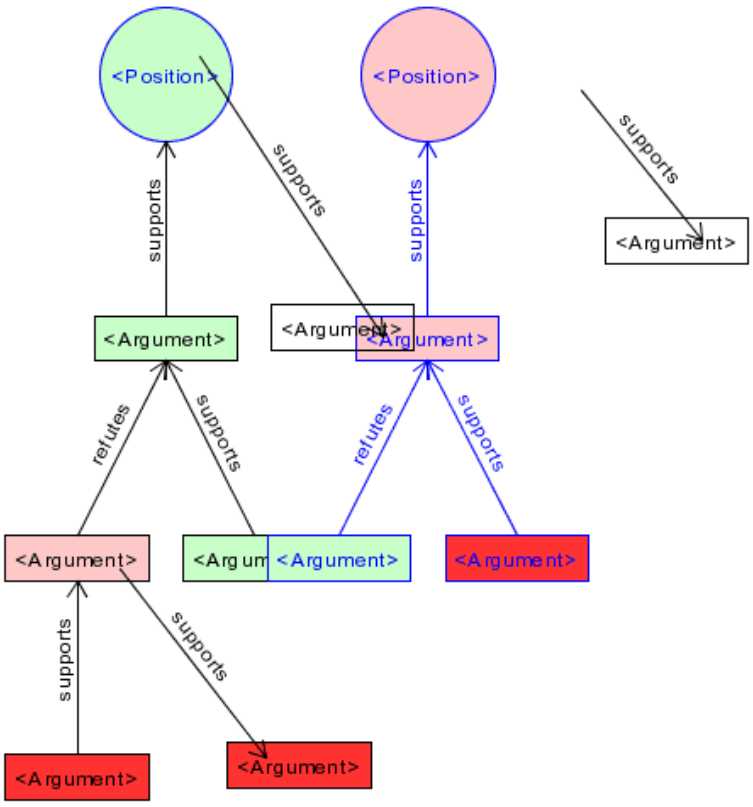


Figure 3.2: Instance of diagram with components incompatible with the Dialectic formalism (in black outline)

3.2.2 The implementation of the Dialectic diagram editor

The Dialectic diagram editor is implemented using the DiaGen (Diagram Editor Generator) system (Minas 2001; Minas 2003). The source code of DiaGen is open and available to download. DiaGen is a system for developing of diagram editors. It consists of programmable functions (written in the Java programming language) that generate the interface components and functions where the argument structure grammar is defined. Specifically the two main parts are: (i) a framework of Java classes that provide generic functionality for editing and analysing diagrams, (ii) a generator program that can produce Java classes, which, after being compiled, build the interface and drawing elements of the generated diagram editor. DiaGen is entirely written in Java and is based on Java 2 SDK. It is therefore platform-independent. DiaGen combines free-hand editing in the manner of a drawing-program with syntax-directed editing when structural modifications of the diagram are required. For example, an argument textbox that is part of a legal combination of diagram elements is positioned automatically and at equal distance from neighbouring argument textboxes. It includes an analysis module to recognize the structure and syntactic (or grammatical) correctness of diagrams on-line during the editing process

To create an editor for the Dialectic notation with DiaGen, the Dialectic notation was formally specified in the DiaGen's scripting language. This specification is processed by the diagram generator component which produces classes in Java and specifies the syntactic structure of the diagram language in the diagram editor. To complete the editor, the software designer (the author) added Java code to build the graphic display and to introduce tools for the manipulation of diagrams. These Java functions denote that the diagram components should be coloured when agreeing with the grammar rules of the diagram syntax).

The definition of the argument structure grammar and semantics of the argument structure notation inside the Diagram Editor were programmed in collaboration with the DiaGen system author Mark Minas (http://www.unibw.de/inf2/DiaGen/).

3.2.3 The Checklist

 consider at beginning and end of planning:	√	a. Which position do I want to defend?
 consider when you create a chain of arguments:		b. Can I support both positions with one or more arguments?
 ask question for any argument:		c. Is argument X too broad and difficult to understand? If so, can I support this argument with another argument that would clarify, illustrate or even enhance its meaning? Argument X is any argument of the diagram
 ask question for any argument:		d. Can I refute argument X?
 always ask for red arguments:		e. Can I refute red arguments?

Figure 3.3: The prompting questions of the checklist

Blackwell and his colleagues introduced the 'Progressive Evaluation' concept as a cognitive dimension of diagrammatic notation that relates closely to teaching and supporting the user in using a notation (Blackwell et al., 2001). Some computer applications, designed to check the logical soundness of an argument may rely on the user/arguer's evaluation (Athina: Rolf & Magnusson, 2003), and not on automated help (e.g. computerised coach in Convince Me: Siegel, 1999). "Evaluation is an important part of the design process, and notational systems can facilitate evaluation by allowing users to stop in the middle to check work so far, find out how much progress has been made, or check what stage in the work they are up to" (Blackwell et al., 2001, p.30).

In the Computer DM, the user is advised to consider a checklist with questions while constructing the diagram (Figure 3.3). It is anticipated that the prompting questions may help the user to reflect on the diagram content and structure and to expand it. The checklist also suggests when the user should consider each question. The checklist icons are used in the instructions provided to the learners of the Dialectic Method.

3.2.4 Feedback from the diagram editor

As described earlier, the Dialectic diagram editor should provide feedback to the user while applying the notation, in a way that encourages her to reflect on the balance of the argumentation. For example, to reflect on whether the position taken is well-supported, and, thus, to improve her argumentation is not fully implemented" is not fully implemented in the Dialectic D-Ed. In the general framework of the Dialectic DM, the user is getting feedback about the balance of argumentation through the colour coding. Direct manipulation resulting into 'illegal' diagram combination informs the user about the semantics of the diagram. This, as well as the red colour used on unrefuted arguments, is a basic way to inform the user about how to improve argumentation structure.

3.3 Method of Study 1a and 1b

3.3.1 Design

The study of the dialectic planning method was completed in three days (Figure 3.4), spread over a period of five weeks of the 10-week long course. On the first day, all participants wrote an essay (baseline essay) on the same essay topic with a time restriction of 90 minutes. No particular instructions were given as to how to plan their essay. On the second day the participants received training on the planning method, either on the Computer DM or the Paper DM, depending on the study they participated. . They wrote an essay as part of the

practice. On the third day, the participants wrote another equally timed essay (90 minutes of planning and writing) on a different topic only this time they were specifically instructed to use the Dialectic Method. All essays were composed on paper.

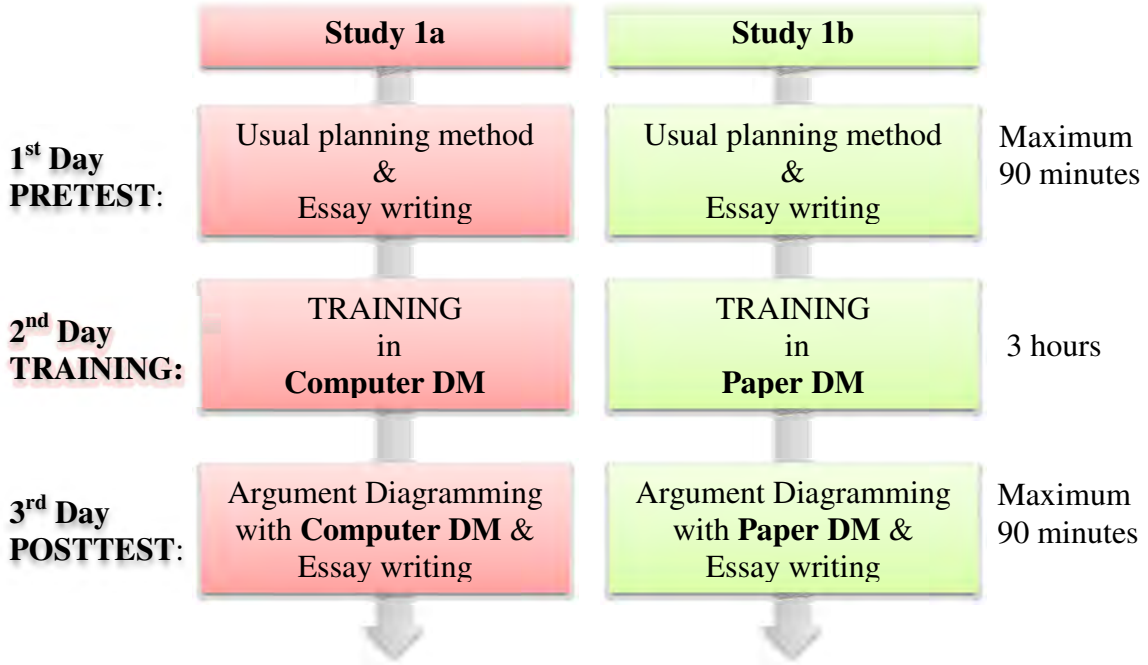


Figure 3.4: Studies 1a and 1b, evaluation of impact of computer-based and paper-based argument diagramming

The content addressed during the 10-week EAP course covered 4 thematic units: Education, Technology and Bio-technology, IT, and Models of Socioeconomic development. The essays that were written as part of the evaluation study were integrated in these thematic units. The baseline essay topic was common for all participants, and so did the posttest essay topic

Pretest essay topic: "Should comparative educational statistics play a decisive role in the design of educational reform?"
Training essay topic: "Where do you stand in the debate on GM foods? Are you in favour or against GM crops?"
Posttest essay topic: "The best way for the least developed countries to develop is to follow the western model. Where do you stand in this debate?"

Table 3.1: Essay topics from studies 1a and 1b

3.3.2 Participants

In order to recruit students to participate in the studies, a presentation was given on the Dialectic Method to the teachers of the EAP course. At the time of the studies, there were nine groups running, which ranged in terms of English ability from very high (groups 1 and 2) to very low (group 9). For each group there was one teacher responsible for the EAP course. Out of nine EAP teachers three teachers volunteered to participate, so the students in their classes were recruited for the evaluation study. The level of English ability of the three recruited groups was 1, 4 and 5.

The EISU school administration did not allow the experiment to separate each group into different conditions. Hence, two groups had to be involved in one study and the other group in another study. Groups 4 and 5 were allocated to study 1a (the computer-based DM) and group 1 was allocated to study 1b (the paper-based DM). Due to these constraining conditions (beyond the control of the researcher), the studies adopted an exploratory approach.

3.3.3 Academic setting of the evaluation study

The study took place at the University of Birmingham English for International Students Unit (EISU) during a 10-week pre-sessional course on academic English. The international students who attend this school every year are final year exchange students or postgraduate students. Most students attend the school because completing a course in EISU is a condition of acceptance set by the University. In particular, the courses in EISU aim to help students improve their general and academic English and get accustomed to the ways of reading, writing and studying expected at a British university (more information on EISU can be found on http://www.eisu.bham.ac.uk/). The director of studies in EISU allowed the Dialectic Method to be integrated in the EAP (English for Academic Purposes) course, and in particular

in a 10-week course, (taking place in August and September 2001). The duration and teaching material in this course was considered appropriate for integrating the Dialectic Method.

3.3.4 Data collection

The group assigned to study 1b (Paper DM) consisted of 12 participants and the group assigned to study 1a (Computer DM) consisted of 23 participants. Although all 36 participants participated in the pretest assessment 2 participants of the computer group were absent on the day of the training. One participant from study 1b (paper group) was absent on the day of the posttest assessment. This reduced the number of the study 1a group to 9. Two of the study 1a group did not hand in their essays, so 21 essays were finally collected from the computer group. In order to balance the two samples during text analysis 12 essays out of the 21 were randomly chosen in order to be analysed.

Study phase	Pretest		Posttest	
	Study 1a Computer	Study 1b Paper	Study 1a Computer	Study 1b Paper
Essays scored for overall quality	21	9	21	9
Essays analysed for argument structure elements	12	9	12	9

Table 3.2: Overview of collected data

3.3.5 Training on the Dialectic Method

The teachers who participated in the study were trained in presenting the Dialectic Method to the participants. A detailed lesson plan was provided to ensure that the way the training was delivered in both groups was comparable, especially in terms of length, quality and practicing tasks. Two hand-outs, one for each group (Paper DM and Computer DM), including the lesson plan, guidelines, a manual of the method, and presentation slides were produced for the teachers.

In order to prepare for the training day, one of the teachers piloted the presentation of the Computer DM in front of her other two colleagues using the material provided material (presentation slides from hand-outs). Three postgraduate students were invited from the School of Electrical Engineering, University of Birmingham to make the pilot more realistic and to pose questions.

On the training day (2nd day of the study) the teachers introduced the Computer DM or the Paper DM, depending on the group they were allocated. During the training, the Computer DM was presented on a computer screen using a video projector while the Paper DM was presented on the whiteboard. An extended hand-out (20 pages), was distributed to every participant. The hand-out covers a manual of the method, examples of use, advice for developing a diagram into an essay, and the tasks required from the participants during the study. The participants practiced using the method following instructions of the hand-out. The computer group moved to a computer cluster room. Both groups spend 2 hours on practicing the method. After practicing the method on their own the participants spent another 30 minutes with their groups discussing how to convert a diagram into an essay. Then the teacher highlighted ways of reflecting on the diagram and using it as an outline for essay writing, as described in the manual. Finally, the participants in both groups were asked to write an essay as homework based on the diagram they planned as part of their practice during the training.

3.4 Method for measuring the quality of argumentative essay

The impact of argument diagramming on the quality of argumentative essay is measured through two perspectives (i) the overall quality and (ii) the argument structure analysis (text – analytic) of argumentative essays. For the first perspective a holistic scale of argumentative essay quality is employed (primary trait scoring). For the second, an in depth analysis of argument structure elements is carried out in order to measure critical elements of argument

structure. The rationale of this twofold approach is to adopt both holistic ratings and text analysis in order to evaluate writing performance (Kellogg, 1994; Reznitskaya et al., 2009).

Overall 5 variables are used to measure the impact of argument diagramming

1. Overall quality of argumentative essay.
2. Supporting elements of argument structure
3. Countering elements of argument structure
4. Refuting elements of argument structure
5. Development in depth of argument structure elements

The following sections present in detail the 5 variables and the procedures applied in obtaining for these variables.

3.5 Overall quality

3.5.1 Theoretical rationale

Holistic quality ratings or reader-focused methods (Schriver, 1990) are a broad category of text assessment where the rater's evaluation is based on given criteria requiring understanding and interpretation of text. A *primary trait scoring* is a kind of holistic rating, consisting of a set of criteria for successful writing on a selected genre. The focus of scoring is on a narrow range of aspects or traits, the most salient criteria associated with the task (De la Paz & Graham, 2002; Lloyd-Jones, 1977). In order to evaluate the impact of the Dialectic Method on writing performance *a primary trait rubric* is adopted (Trigwell, 1992) and applied as a marking method of the essay content. An independent evaluator reads the text and applies the rating scheme, following guidelines.

3.5.2 Analytic procedure

In order to evaluate the impact of the Dialectic Method on writing performance, a primary trait rubric was used (Trigwell, 1992). It is based on an essay grading scheme which was originally proposed by the Educational Services and Teaching Resources Unit at Murdoch University (Table 3.3). The application of guidelines was also adopted (Table 3.4). The scoring was done by an independent evaluator, a teacher from the EISU School who was not involved in the study.

The primary trait rubric consists of four parts (Table 3.3). In the first part, the GENERAL STRUCTURE items *Relevance of topic, coverage of topic and adequate analysis* refer to rhetorical, content and textual aspects of the essay. The four items grouped under ARGUMENT, refer to argumentation strategies or argument moves. The wording in the 3rd and 4th item of ARGUMENT anticipates the possibility that the participant has not voiced a personal position clearly. The CONCLUSION section refers to how the developed argumentation is reflected in the conclusion, where usually the writer's position is presented to confirm if already presented in the introduction. One of the problems in argumentative writing is to take a position and support it throughout the essay. The reader anticipates in the conclusion information that is relevant to the writer's position. This presupposes that the writer has explored her arguments in relation to a position (semantic structure) and in the conclusion she presents a reminder a summary or a discussion of the position. In some cases participants realise that the support of their position is weak and may decide to change their mind, even if they are half way in their writing, and to conclude with another position (Oostdam et al., 1994). This is not a good rhetorical strategy. The ENGLISH section includes one item only; language in general is possible to affect the scoring of all items.

Itemised rating scale					
1.GENERAL STRUCTURE					
a. Essay relevant to topic	4	3	2	1	Essay has little relevance
b. Topic covered in depth	4	3	2	1	Superficial treatment of topic
c. Adequate analysis of subject	4	3	2	1	Descriptive account of subject
d. Logically developed argument	4	3	2	1	Essay rambles and lacks continuity
2. ARGUMENT					
a. The student has clearly taken a position	4	3	2	1	The student has not taken a clear position
b. The student has supported her position (and other presented positions) with arguments	4	3	2	1	The student is not providing support for hers or any other presented position
c. The student is referring to both arguments and counterarguments (or advantages and disadvantages) in relation to her position and other presented positions.	4	3	2	1	The student is NOT referring to counterarguments (or disadvantages) in relation to her position OR any presented position.
d. The student has mentioned arguments in favour of the opposing position and has refuted them	4	3	2	1	The student has not considered at all the opposing position nor its advantages
3. CONCLUSION					
a. The student's essay concludes nicely	4	3	2	1	The student's essay has no conclusion
b. In her conclusion, the student refers back to one or two main points of her argumentation and draws a conclusion.	4	3	2	1	The student's conclusion is not relevant to her argumentation
c. The student's conclusion is consistent with her position	4	3	2	1	The student's conclusion contradicts her position
4. ENGLISH					
The written English was very good	4	3	2	1	The written English was very bad

Table 3.3: The primary trait rubric (Trigwell, 1992)

	ARGUMENT : Guidelines on the itemised rating scale			
	4	3	2	1
Clear Position	The student is clearly taking a position; she has defined more than one position in relation to the topic in question and has clearly taken one position.	The student's intention is to take a clear position despite language difficulties or lack of conceptual clarity with regard to the topic	The student avoids commitment to one position; she is taking the 'middle' way. The essay lacks in a position that stands out	The student changes her mind during the essay development. She takes a position in the beginning, which later she seems disregard or ignores.
Support to position	The student is supporting (developing) her position and possible opposing position(s) with arguments	The student is supporting her position but little is said in favour of the stated opposing position.	The essay develops around one position. Other positions maybe stated but not supported.	Very little or no information is provided in support of a position.
Counterarguments	All positions presented, including the one the author is taking and possible opposing ones are developed with arguments and counterarguments.	The positions presented, are developed with lesser counterarguments than when a 4 is normally awarded	Lesser and unsuccessful attempts to develop counterarguments are noted. Unsuccessful counter argumentation may be related to lack of conceptual clarity with regard to the topic or poor knowledge of linguistic indicators for expressing counter argumentation.	no counter argumentation is noted
Refutation	Most counterarguments are refuted.	Some successful and some unsuccessful attempts to refute counterarguments are noted..	Counterarguments are not refuted or are unsuccessfully refuted.	The student does not consider arguments supporting the opposing position or does not consider at all the opposing position. Counter argumentation and refutation are not applicable.

Table 3.4: Guidelines on application of the itemised rating scale

3.5.3 Evidence of reliability

The primary trait rubric consists of 12 items which are grouped in 4 sections: General structure (4 items), Argument (4 items), Conclusion (3 items) and English (1item). The 12 items of the primary trait rubric were tested for scale reliability in order to confirm that they measure the same construct as a scale. Cronbach's alpha was .92 for the pretest scores and .91 for the posttest.

When the reliability of the hypothesized subscales were tested separately alpha for General structure was .92 for pretest scores and .91 for the post test; alpha for Argument was .55 for pretest scores and .72 for posttest; alpha for Conclusion was .85 for pretest scores and .95 for posttest. However, those subscales were not used further as they were not backed by adequate empirical evidence.

A factor analysis would have help to validate such subscale structure. However, due to the limited sample size it was not possible to conduct a factor analysis. Instead, a new construct, the ‘overall quality’ of argumentative essay is computed on the basis of the mean value of the 12 items (‘OVERALL QUALITY pre’ and ‘OVERALL QUALITY post’).

3.6 Argument structure analysis

3.6.1 Theoretical rationale

The *analytic* approach starts from properties of the text that are easily identifiable. For example, analysis or representation of text structure based on propositional analysis “offers a formal system for representing the micro- and macrostructure of a document” (Kellogg, 1994, p.59). In analytical approaches, such as propositional analysis (Kintsch, 1974), coherence

analysis (Halliday & Hasan, 1976), and feature analysis (Sharples, 1985), the categories of analysis, are applied at the sentence, connective conjunctives, and word level.

The role of structure analysis in the evaluation of essays should be seen in the context of objective analysis that starts from properties of the text and aims to evaluate complex structures of argumentation. In second language (L2) assessment, language difficulties may obscure the writer's actual attempt to formulate argumentation. The adopted method of discourse structure analysis examines the structures and underlying procedures from a different perspective than that of the essay evaluator. The emphasis is more on the argument structures than on the accuracy of language used to express these structures.

Crammond's model (1997, 1998) of representing argumentation structures is considered suitable for analysing the complexity of argumentation structures. *Argumentation structure* is understood as a complex network of semantically interlinked arguments. *Argument* is defined here in terms of a modified and elaborated Toulmin model (Crammond, 1997, 1998), consisting of claim, data, warrant and other components that will be discussed later.

Crammond's model is adopted for four main reasons. First, Crammond's model represents the structure and interdependency of arguments in extended persuasive discourse, i.e. argumentative discourse that develops around a main claim or position. Second, it defines the role of text segments in a complex argumentation structure and the relations between arguments including the functions of counter argumentation and refutation.

Third, it can serve as point of reference for estimating the participant's level in terms of the range and complexity of argument structures they use. Crammond's model has already presented empirical results in identifying developmental differences between experts and students in using complex argumentation (Crammond, 1997, 1998) and has been considered

for its analytical potential (Coirier et al., 1999; Lunsford, 2002; Yeh, 1998a, 1998b). Although further validation of the model with L2 writers may be needed (given the current study participants are non-English native speakers), it can serve as a point of reference for establishing the level of argumentation skills of the participants. Other methods of discourse structure have been reviewed, such as PISA (Sanders & van Wijk, 1996; van Wijk & Sanders, 1999) and Rhetorical Structure Theory (Mann & Thompson, 1988, 1992). However the scope of their conception is generic to text analysis and not specific to argumentation. They have been used in the analysis of argumentation structure but there are limited empirical findings on the evaluation of argumentative text as result of an intervention or as definition of developmental levels of argumentative writing expertise.

Finally, with a small adaptation the model is possible to represent argumentation structures at both a Macro- and Microstructure level. Table 3.5 describes 4 levels of representation and illustrates how Crammond's model is used in this thesis in order to conceptualise 4 levels of argumentation structure analysis. This analysis starts at a Micro-structure level, level 1, where the text is segmented in T-Units. The text segments are encoded according to the Argument Structure Grammar (Level 2), where the use of codes and relation proposed by the Grammar (Crammond, 1997, 1998) are considered at a Microstructural level. Moving onto the following level, level 3, the scope of analysis refers to how the components encoded in the previous level contribute to the coherence of the text. In other words, the text is now seen from a Macro-structure point of view. Complexity of argumentations structures refers to chains of arguments, how arguments (as defined above) are embedded in other argument structures, thus, applying the proposed model (Crammond, 1997, 1998) in a recursive way. The Argumentation Structure Components encoded in Level 2, and interlinked (co-ordinately, subordinately combined or embedded) at Level 3, are assigned to 4 categories according to

the main or implied position of the text. This is considered to be level 4, where Crammond's model is extended to define the balance and orientation of argument structure components.

Level	Title level	Scope	Measures
Level 4	Orientation and Balance of Argument Structure components	Orientation of Argumentation Structure components with regard to the position	Support Counterargumentation Refutation (Neutral) Non-argumentative
Level 3	Complexity of argumentation structures (Crammond 1997; 1998)	Coherence of essay.	Embedded arguments Argument chain depth Number of chains Density of arguments per text Subclaims
Level 2	Argument structure components (Crammond 1997; 1998)	Use of argument structure components: Application of Argument Structure Grammar	Argumentation Grammar structures: Support and Justification Counterargumentation and Refutation
Level 1	Segmentation	Objective unit of analysis	Text Segments, T- Units

Table 3.5: Levels of representation of argumentation structures in Crammond's model

Crammond's analytical model derives from a model of semantic representation in discourse. The complex text analysis procedures proposed by the model refer to the framework of Frederiksen (Frederiksen, 1975, 1987), which allows a precise description of written argumentative texts. Crammond's model (1998) was conceived in order to identify the developmental features and characteristic weaknesses of students' persuasive writing by referring to argument structure. Her model is based on Toulmin's (1958) model but also modifies Toulmin's schematic representation by allowing two aspects of complex argumentation to be represented, which are very important in the current analysis and representation of Argumentation Structure.

First, argument in Toulminian terms is used as a unit of analysis of persuasive discourse. The basic claim-data and warrant model is validated elsewhere (Knudson, 1992; Scardamalia & Paris, 1985) as the most significant predictor of holistic writing scores, assigned to students' texts. But what is more important is that Crammond's model allows the analysis of extended persuasive discourse. Her elaborative modifications to Toulmin's model allow the representation of chains of arguments. Chains of arguments can be created by subordinately compound arguments. Chains of arguments, related in coordinated way, form a tree like graph, namely, the entire argument model of extended persuasive discourse (Crammond, 1998, p.237). Seeing argumentation structure from this perspective allows us to discuss complexity of argumentation structure.

Second, Crammond's (1998) model gives emphasis to *counter argumentation and refutation* by including some new components to Toulmin's basic model. The countered rebuttal consists of a potential rebuttal, in other words a challenging (or counter arguing) statement, and a response to rebuttal, that is the refutation to the challenging statement (see example in Figure 3.5, p.85). The component of potential rebuttal, as well as the reservation component (equivalent to the exception component in Toulmin's terms, which limits the applicability of a claim) and alternative solution component are forms of counter argumentation.

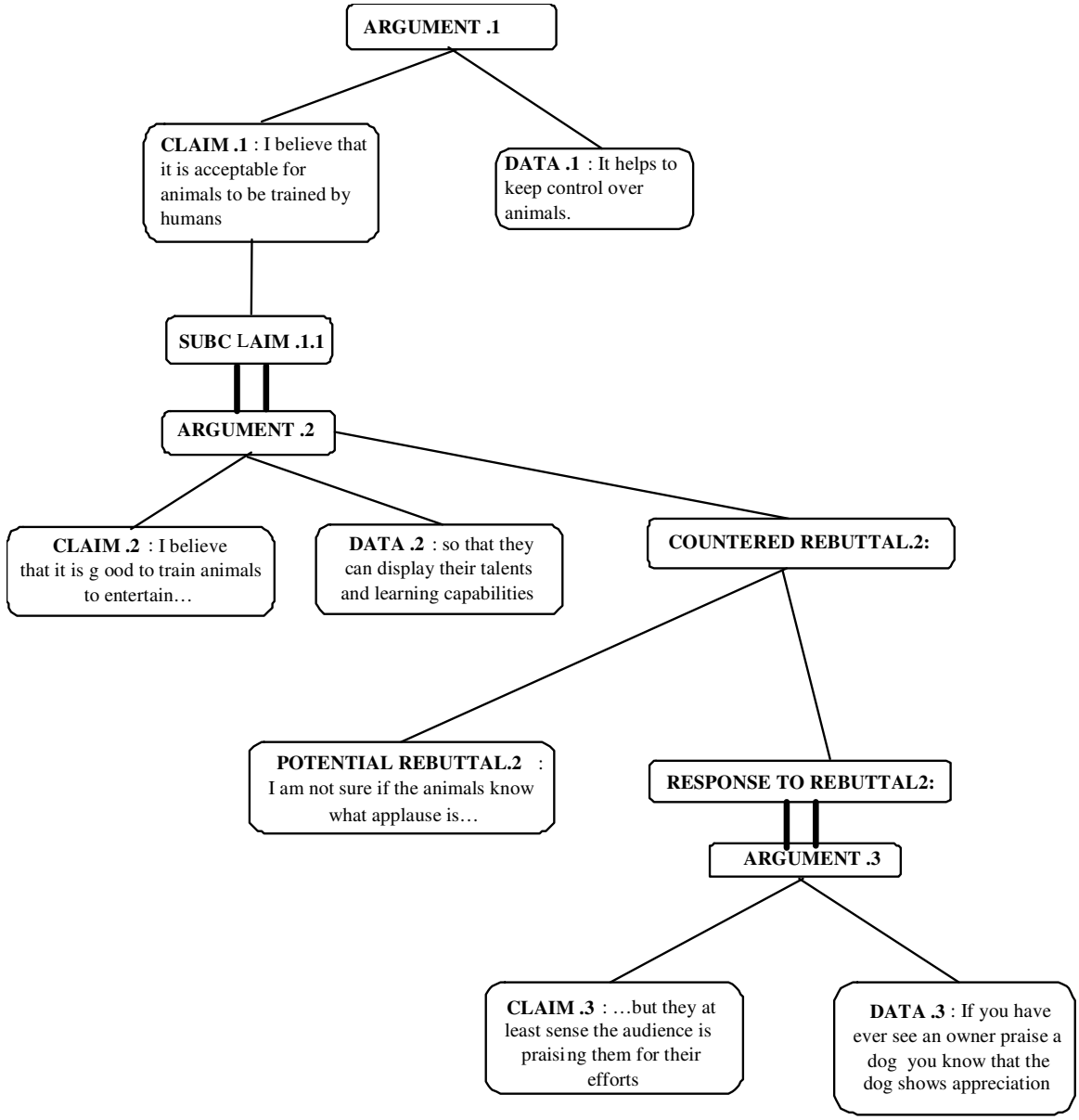


Figure 3.5: Example of tree diagram yielded by the application of the model

3.6.2 Analytic procedure

Table 3.5 (p. 83) illustrates 4 levels that reflect an incremental application of argument structure semantics starting from the text segmentation level (level 1). Except level 1, which refers to the segmentation of text in units, the other 3 levels represent different aspects of semantic and rhetorical argumentation structure analysis.

The analysis procedures start with the segmentation of the text. At segmentation level, the analysis of text in segments is done by identifying a) major (finite) clause and b) adjuncts bound clauses. The latter are secondary clauses introduced with binders (until, when, because, if, since, etc.). As in Crammond's linguistic analysis (Crammond, 1997, p.46), the clause analysis is based on Winograd's (Winograd, 1983) description of clauses types. Segments are then numbered and the total number is noted.

At level 2 and 3, the essay protocols were analysed on the basis of an Argument Grammar (Appendix II) formalised in a set of production rules (Crammond, 1997, 1998). The links proposed by Crammond were simplified to facilitate the coding process, while the proposed components were kept the same (Appendix III). The components of Argument Grammar (claim, subclaims, data, data backing, warrant, warrant backing, constraint, potential rebuttal, countered rebuttal, reservation and alternative solution) were identified in the essays by one analyst, in this case the author of the thesis.

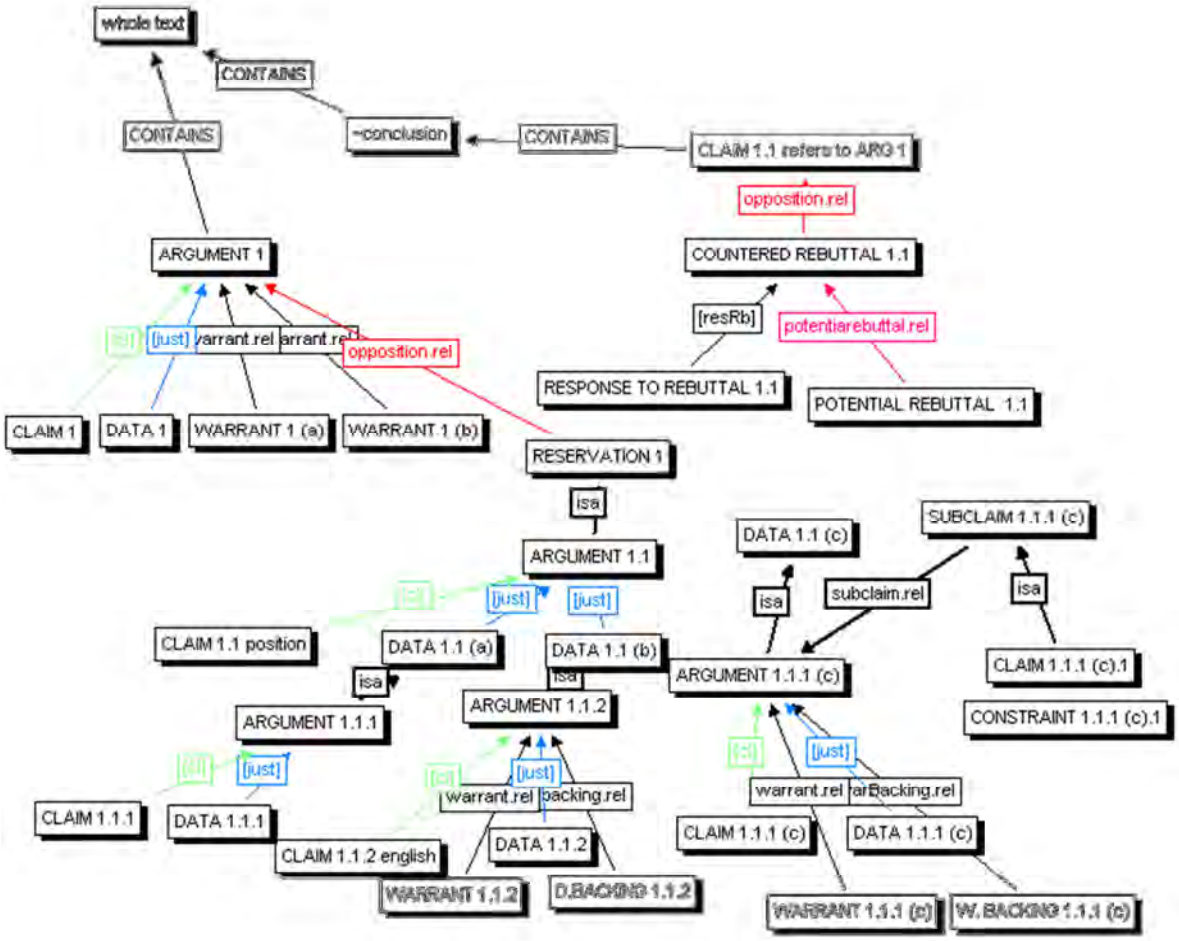


Figure 3.6: Tree structure of essay representing hierarchy and complexity of argumentation structure components

The components Claim, Data, Data Backing, Warrant, and Warrant Backing, are defined as in Toulmin's model. Definitions for the remaining Subclaim, Constraint, Reservation, Potential Rebuttal, Countered Rebuttal (including a potential rebuttal and a response to rebuttal), and Alternative Solution are given in Appendix I. For a detailed description of the components and relation of Argument Grammar the reader may refer to (Crammond, 1997, p. 51-60) and (Crammond, 1998, p.257-264).

The analysis of argument structure of the segmented texts was facilitated by atlas.ti, a software tool that supports the management of qualitative analysis and representation of results. Figure 3.7 shows one of the essays annotated with the Argumentation Structure

Components in atlas.ti. Note that the last two sentences are coded as Response to Rebuttal. Figure 3.6 shows how the annotated components are interlinked forming a hierarchy of structures.

In order for a piece of discourse to be classified as an Argument, it has to consist minimally of a Claim-Data complex. Such Argument units are identified and, along with Claims, indexed (numbered) for reference purposes subsequent to the coding of argument components. This step involves the double coding of some text segments. The double coding is possible for the Subclaim, Data, Warrants, Reservations, Countered Rebuttals and Alternative Solution. Each of this can be coded as an argument, consisting at least of a Claim-Data complex, the basic argument. The argument is then considered an embedded one. Each of the above mentioned structures could also be coded as a claim only, to which may be related a subclaim. In this case although we do not have embedded arguments a chain is formed. Thus chains are generated when embedded Arguments and Subclaim relations are coded.

The analysis of each essay according to the Argument Grammar (Crammond, 1997) yields a tree structure diagram for each essay. Figure 3.6 is the tree structure diagram for the text annotated with the Argument Grammar components, shown in Figure 3.7.

Figure 3.7: Essay annotated with Argument Grammar Components

Levels of argument structure analysis

Level 4: Balance and Orientation of Argumentation Structure components

Forty-two essays, 9 from the paper group and 12 from the computer group, written before (protest) and after (posttest) the intervention, were analysed according to the Argument Grammar and procedures presented in the previous sections. The components of Argument Grammar (structure, claim, subclaims, data, data backing, warrant, warrant backing, constraint, potential rebuttal, countered rebuttal, reservation and alternative solution) were identified in the essays. The components were then grouped semantically in 4 greater categories, according to their relation to the main position of the essay:

1. SUPPORT: components supporting the position,

2. COUNTER: components challenging the position or expressing counter argumentation,
3. REFUTE: components refuting the challenging statements
4. NEUTRAL: components referring to scene setting, or background information.

The components' number from each category is divided with the number of the segments in each essay. Thus, the length of the essay, and specifically the main and secondary clauses, are considered when the balance and orientation of argumentation structure components is computed. The four measures on level 4 are therefore:

1. SUPPORT: supporting components / T-Units per essay
2. COUNTER: counter arguing components / T-Units per essay
3. REFUTE: refuting components / T-Units per essay
4. NEUTRAL: neutral components / T-Units per essay

Level 3: Complexity of Argumentation Structure

The length of argument chains and number of embedded arguments are counted as a measure of argument complexity. As already mentioned chains are generated when embedded Arguments and Subclaim relations are coded. The example (Figure 3.5), given by Crammond, illustrates this measure. In the example the SUBCLAIM 1.1 and RESPONSE TO REBUTTAL .2 are double-coded as embedded Arguments, ARGUMENT .2 and ARGUMENT.3 respectively. The depth of the argument chain is 3 because, starting from the top ARGUMENT.1, two more levels of argument follow, represented by embedded arguments, ARGUMENT .2 and ARGUMENT.3

The measures to be taken into account for complexity of argument structure are:

1. Embedded arguments, as defined above

2. Argument chain depth- maximum length: The depth measure represents the longest argument chain. Embedded arguments and subclaim relations form argument chains.
3. Number of chains: This measure represents the number of chain branches. A chain is formed with at least one argument or one subclaim relation. For example, in Figure 3.5 (p. 85), there are two chains, one that starts at Argument 1 and ends at Argument 2 and another that roots at the Countered Rebuttal 2.
4. Density of arguments per text: This measures represent the frequency of data-claim-complex among the total number of T-Units per essay
5. Subclaims

Level 2: Use of Argumentation Structure Components

The Argumentation Structure Components, the syntax of which is defined by the Argumentation Grammar are grouped under broad categories:

1. Support and Justification encompassing Data, Data Backing, Warrant, Warrant Backing

2. Counterargumentation and Refutation which include Potential Rebuttal, Reservation, and Alterative solution, which are forms of Counterargumentation, and Response to Rebuttal which in effect is synonym to Refutation.

The second category of measure is considered more relevant with regards to the impact of the intervention. As a Response to Rebuttal component usually coexists (responds to) with a Potential Rebuttal component the results from the two measures are expected to be close.

However, they are not expected to be identical. I is possible that some Potential rebuttals are no countered due to the arguers failure or neglect to respond to the potential rebuttal

Level 1: Segmentation

1. T- Units: The identification of T-Units is done by identifying a) major (finite) clause and b) adjuncts bound clauses. The latter are secondary clauses introduced with binders (until, when, because, if, since, …).
2. Encodings: All T-Units are encoded according to the Argument Structure Grammar

3.6.3 Evidence of reliability and summary of measures

Supporting, countering and refuting elements of argument structure

The 3 variables of the title above derive from Level 4 of the text analysis, which is the higher level of analysis. The reader is reminded that the text analysis is a bottom up procedure, starting with the segmentation of text in T-Units (Level 1). Then T-Units are coded in terms of Argumentation Structure components following Crammond's Argument Structure model (1998) (Level 2). At the next level up (Level 3) the components are represented on a complex network of interlinked argument relations consisting of argument chains. Twenty-one essays were segmented in T-Units and then coded at levels 2 and 3 (Section 3.5.3). At Level 4 the T-Units are codded as supporting the position, challenging the position, and refuting the challenging components, depending on their semantic relation to the position of the essay, as this is inferred during coding at levels 2 and 3. The 4^{th} variable of the Level 4 argument structure analysis, the neutral code, is excluded from the statistical analysis as it does not convey values that relate to argumentation structure. Narrative elements of the introduction, namely background or other contextual information are coded as neutral. Finally, the 3 variables are computed as per total number of T-Units in each essay:

1. SUPPORT: supporting T-Units / T-Units per essay
2. COUNTER: counter arguing components / T-Units per essay
3. REFUTE: refuting components / T-Units per essay

Evidence of reliability for the 3 measures

As confirmed after exploring the scale reliability (α=-5.56), there is negative covariance between the 3 variables. Hence, these 3 variables convey the 3 different orientations that argument structure components may take in relation to the essay position. Collectively the 3 variables convey the balance between adopted argumentation strategies. A myside bias approach is defined with increased supporting arguments if compared to counterarguments. A more balanced relation between supporting and countering arguments shows signs of greater integration of counterarguments.

Development in depth

The final measure of argument quality is the development in depth. Following Crammond's model (1997, 1998), argumentation structure is understood as a complex network of semantically interlinked arguments which is formed by chains of arguments. Following the coding procedure, chains are generated when Embedded arguments and Subclaim relations are coded (Level 3 coding is also described in Section 3.5.3). An embedded argument is an argument structure component, for example a refutation, which consists of more than a claim. That is, the claim of the refutation is complemented by a data structure, possibly elaborated by a warrant structure, or enhanced by any other component of the Argument Structure Grammar (e.g. warrant backing, data backing etc.). Another way to deepen the network of semantically interlinked arguments is with a sub claim. A sub claim functions as a secondary or minor claim. Based on the definition of chain generation the variable 'development in DEPTH' is computed by the sum of embedded arguments and subclaims.

3.7 Results

3.7.1 Data analysis

In study 1a, hypothesis 1a states that the use of the Computer DM as pre-writing strategy is expected to improve the quality of argumentative essays. Similarly, in study 1b, hypothesis 1b states that the Paper DM group is also expected to improve the quality of argumentative essays. A repeated measures design is applied to explore Hypothesis 1a and 1b independently.

Quality of argumentative essays

Measures	Computer group N	Paper group N
OVERALL QUALITY of argumentative essays	21	9
SUPPORT components	12	9
COUNTER components	12	9
REFUTE components,	12	9
Development in DEPTH	12	9

Table 3.6: Measures and sample size for quality of argumentative essays

The quality of argumentative essays is measured through the variables OVERALL QUALITY of argumentative essays, SUPPORT components, COUNTER components, REFUTE components, and development in DEPTH, presented in the previous section. Inspection of the Histograms and the Normal Q-QPlot did not confirm the shape of a normal distribution for all the 5 variables (observations were conducted for the computer and paper group separately). An exploratory data analysis was also conducted to determine the parametric assumption of normal distribution. Results from the Kolmogorov-Smirnov test for normality indicated that the distribution deviated significantly from a normal distribution for the computer group's score of REFUTE (D =.470, p = .000) and for the paper group's score of REFUTE (D =.389,

p = .000) and DEPTH (D = .318, p = .009). That is, in terms of these variables, the values are not normally distributed. Regarding the remainder variables, the parametric assumption of normality is worrisome given the small sample sizes (n<30 see Table 3.6). Nonparametric tests are generally considered a good option in this case (Conover, 1980; Hoskin, 2013 Retrieved).

In view of the mixed indications regarding the parametric assumption of normality and the small size of sample (Table 3.6), the data analysis opts to nonparametric procedures.

3.7.2 Study 1a: Computer group

The Wilcoxon Signed-Rank test is used to compare values from 5 measures at pretest against measures at posttest time. Wilcoxon (Signed Rank) tests were conducted five times, for each of the examined variable, to evaluate whether the use of Computer DM improves the quality of argumentative essays. The results indicated a significant difference for OVERALL QUALITY, $z = –2.57$, $p < .05$, and REFUTE components, $z = –2.59$, $p < .01$ (Table 3.7). The differences in scores for SUPPORT (z = -1.09 p>.05), COUNTER (z =-1.41 p>.05) and DEPTH (z =-1.21 p>.05) were not significant. Table 3.7 presents the medians for the 5 variables at pretest and posttest assessment. In terms of OVERALL QUALITY, the assessment of the independent evaluator improves from MD=1.93 in the pretest to MD=2.41 in the posttest. Gain is also seen regarding the REFUTE components. The pretest essays of the computer group are almost devoid of refuting components (MD=0, Mean=0.5 SD =.15) while in the posttest there is significant increase in refutation components (MD=.31, Mean=.30 SD =.26). This significant increase in refutation is likely to be related to the increase in overall quality.

3.7.3 Study 1b: Paper group

Wilcoxon (Signed Rank) tests were conducted on the 5 variables to evaluate whether the use of Paper DM improves the quality of argumentative essays. The results did not indicate significant differences between the pretest and posttest means of the ranks (OVERALL QUALITY $z = -2.37$ $p>.05$, SUPPORT $z =-.17$ $p>.05$, COUNTER $z =-.65$, REFUTE $z =-1.68$ $p>.05$ DEPTH $z = -1.33$, $p>.05$). Table 3.8 presents the medians for the 5 variables at pretest and posttest assessment. Lack of significant change in SUPPORT, COUNTER and REFUTE components scores is likely to be related with lack of change in OVERALL score.

Study 1a: Computer DM	N	Mean	SD	Median	Mean Rank
OVERALL QUALITY *					
Pretest	21	2.03	.57	1.93	10.38
Posttest	21	2.47	.61	2.41	11.15
SUPPORT					
Pretest	12	.96	.41	1.08	6.63
Posttest	12	.74	.39	.79	6.25
COUNTER					
Pretest	12	.26	.26	.23	4.20
Posttest	12	.42	.17	.41	8.14
REFUTE **					
Pretest	12	.05	.15	.00	2.00
Posttest	12	.30	.26	.31	5.89
DEPTH					
Pretest	12	11.41	4.62	11.00	5.88
Posttest	12	13.41	4.18	13.00	6.81

* $p<0.05$ ** $p<0.01$

Table 3.7: Means, standard deviations, and mean ranks of the study 1a group scores

Study 1b: Paper DM	N	Mean	SD	Median	Mean Rank
OVERALL QUALITY					
Pretest	9	2.55	.30	2.50	4.90
Posttest	9	2.52	.68	2.50	5.13
SUPPORT					
Pretest	9	.58	.33	.66	4.80
Posttest	9	.55	.39	.38	5.25
COUNTER					
Pretest	9	.53	.34	.48	5.60
Posttest	9	.40	.29	.37	4.25
REFUTE					
Pretest	9	.17	.27	.00	3.00
Posttest	9	.40	.29	.31	5.00
DEPTH					
Pretest	9	10.00	5.61	9.00	2.83
Posttest	9	14.55	7.56	13.00	5.50

Table 3.8: Means, standard deviations, and mean ranks of the study 1b group scores

3.7.4 Validity of discourse analysis

The argument structure analysis followed Crammond's protocol of analysis (1997, 1998) and came to four measures: SUPPORT, COUNTER, REFUTE and DEPTH. Thus it is possible to compare the scores of studies 1a and 1b with those of Crammond's study.

The set of results that Crammond provides refer to four levels of expertise: sixth-, eighth-, and tenth-grade students, as well as Experts, i.e. professional writers (tenth-grade students are at the final year of secondary education). Crammond's model has been referenced widely as it provides a point of reference for developmental changes in argumentation skills. It is the only study that defines developmental changes through text-based analysis.

Based on the full set of results from Crammond's analysis, it is possible to compare with the participants of studies 1a and 1b in terms of scores that relate to the measures development in DEPTH and REFUTE. Table 3.9 reports the means and standard deviations for Crammond's participants and Table 3.10 presents the same for study 1a and 1b participants. Countered rebuttal, or else refutation, are reported as counts in Table 3.9 and Table 3.10 while the REFUTE components measure (reported in. Table 3.11, Table 3.7, Table 3.8) is the ratio of refuting components per total number of segments. Embedded arguments and subclaims reported here in counts, are computed together in the development in DEPTH measure.

Embedded claims show the writer's ability to elaborate elements of the argument structure in depth. The claim of a counterargument (or potential rebuttal) for example, is not just a claim but a complete argument, consisting of data, possibly a warrant and a warrant backing. Another way to elaborate on a claim is to add a subclaim. The subclaim is a minor claim to main claim. Table 3.9 shows that at expert level, writes use embedded arguments much more than subclaims, thus it could be argued that embedded arguments characterise higher writing

		Embedded arguments	Subclaims	Countered Rebuttal
	N	M ± SD	M ± SD	M ± SD
6th grade	12	1.67 ± 1.30	2.25 ± 2.14	.33 ± .65
8th grade	12	1.92 ± 1.78	2.25 ± 1.66	.42 ± .79
10th grade	12	2.25 ± 2.18	2.17 ± 1.90	1.17 ± 1.19
Expert	7	10.00 ± 6.6	3.71 ± 2.40	3.29 ± 1.25

Table 3.9: Crammond's (1997) scores (*M, SD*) for Development in depth and Refutation for four age groups

			Development in DEPTH		REFUTE
			Embedded arguments	Subclaims	Countered Rebuttal
		N	M ± SD	M ± SD	M ± SD
Study 1a: Computer group	Pre	12	8.83 ± 2.82	2.58 ± 2.39	0 ± 0
	Post	12	10.50± 3.99	2.92 ± 3.14	1± 0.85
Study1b: Paper group	Pre	9	8.33 ± 5.34	1.67 ± 1.22	0.89 ±0.78
	Post	9	12.22 ± 6.48	2.33 ± 2.06	0.89 ± 1.05

Table 3.10: Computer and paper group pretest and posttest scores (*M, SD*) for Development in depth and Refutation variables

expertise. Both groups, at pretest and posttest, score highly in terms of DEPTH. Thus, they appear to be at a similar range as expert writers, if compared with Crammond's scores. Neither of the groups improved significantly according to the repeated measures comparison

in terms of development in DEPTH. From this point of view, a ceiling effect could be claimed here, in particular in terms of embedded arguments.

However, it is not possible to infer whether the embedded arguments and subclaims function as supporting, countering or refuting components. It could be that, in the case of the computer group, the supporting arguments are developed in depth, while counterarguments are mentioned in passing; or that the paper group refutes counterarguments without developing the refuting statement in depth. In that sense, both groups could improve further in developing essential argument structure components. In other words, a measure of improvement in essay quality should take into account the development of depth of different argument moves.

The comparison with Crammond's study also shows that study 1a and study 1b participants' means (Table 3.10) are lower than Experts (Table 3.9) in terms of Refutation count (countered rebuttal). The computer group participants include no or very little refutations in their pretest essay. In the posttest they improve significantly and advance to the level of tenth-grade. On the other hand, the level of the paper group is within the low range of tenth-grade at baseline, and remains the same in the posttest. In terms of the REFUTE measure, a ceiling effect can be safely excluded for the paper and the computer group.

3.7.5 Exploratory comparison at baseline

The difference in English ability motivated an investigation to explore whether the groups also differ in terms of measures of quality in argumentative essay. A Mann-Whitney *U* test was conducted to evaluate the hypothesis that the paper group would score significantly higher than the computer group at baseline in terms of quality of argumentative essay (Table 3.11). The results of the test were in the expected direction and significant, in terms of

OVERALL QUALITY, z = -2.53, p < .01, SUPPORT z = -1.84, p < .05 and COUNTER z = -1.92, p < .05. Table 3.11 presents the means and mean ranks for all variable scores at baseline.

The comparison shows that the computer group's argumentation strategies differ from those of the paper group (Table 3.11). Computer group essays refer to arguments supporting the position (Mean Rank= 13.37) more than the paper group does (Mean Rank= 8.11). Furthermore, the computer group's essays include more SUPPORT components (Mean Rank=13.37) than COUNTER components (Mean Rank= 8.75). Additionally, the computer group's essays include almost half the amount of COUNTER components (Mean Rank= 8.75) in comparison to the paper group (Mean Rank = 14.00). It can be argued that at baseline the computer's group exhibits a myside bias schema (Perkins, 1985; 1991; Wolfe & Britt, 2008; Wolfe et al., 2009). Writers influenced by this schema tend to exclude or ignore information that does not support their own position.

	Computer DM					*Paper DM*				
Pretest scores	N	Mean	SD	Median	Mean Rank	N	Mean	SD	Median	Mean Rank
OVERALL QUALITY*	21	2.03	.57	1.93	12.83	9	2.55	.30	2.23	21.72
SUPPORT **	12	.96	.41	1.08	13.37	9	.58	.33	.66	8.11
COUNTER ***	12	.26	.26	.23	8.75	9	.53	.34	.48	14.00
REFUTE	12	.05	.15	.00	10.17	9	.17	.27	.00	12.11
DEPTH	12	11.41	4.62	11.00	12.21	9	10.00	5.61	9.00	9.39

*p<0.01 **p<0.05 ***p<0.05

Table 3.11: Pretest comparison scores of computer and paper group (Mean, SD and Mean Ranks)

The paper group, on the other hand, integrates more counterarguments than the computer group (Table 3.11). In particular, the paper group's SUPPORT components (Mean Rank = 8.11) and COUNTER components (Mean Rank = 14.00) are in balance. The scores also show that most of COUNTER components are refuted (Mean Rank = 12.11). It can thus be argued that at baseline the paper group integrates and refutes counterarguments. This is considered a more advanced argumentation schema than the myside bias schema.

3.8 Discussion

3.8.1 Study 1a

The comparison between pretest and posttest results of the group who used the computer-based argument diagramming method confirmed Hypothesis 1a. The group using the Computer-based DM produced essays of significantly improved overall quality while these essays included significantly more refuting statements. However a number of important factors should be taken into account to interpret these results.

The computer group at baseline has demonstrated a very low argumentative quality. For instance, the independent rater found the essays of the computer group at the baseline as of significant lower overall quality than the essays of the paper group (Table 3.11). Similarly the analytic method (text analysis) showed that the argumentative structure of the essays produced by the computer group was less sophisticated than the argumentative structure of the essays produced by the paper group: at baseline the computer group focused mainly on supporting the position, putting very little emphasis on countering the position. Furthermore almost no attention was paid to refutation by the computer group in the pretest, demonstrated when the results of the text analysis are compared with the results of other studies like the one by Crammond (1997).

In other words, the essays produced by the computer group seem to come very close to a myside-bias approach, where writers tend to exclude or ignore information that does not support their own position (Wolfe & Britt, 2008; Wolfe et al., 2009). The increased supporting argumentation and the limited countering argumentation are indications of low ability in argumentation (Nussbaum & Edwards, 2011; Nussbaum & Schraw, 2007; Perkins et al., 1991).

In contrast, the computer group appears to adopt more advanced argumentation strategies in the posttest essay by enhancing significantly the refutation element of their argumentation (the number of refutations in the posttest essays of the computer group increased from negligible to the equivalent of a tenth-grade student according to Crammond (1997)). However there are two ways to interpret the increase of refutation: first, the essay can include more refutation moves, that is, more counterarguments are refuted; second, refuting statements are elaborated and developed more in depth. The pretest/posttest comparison showed a significant increase in the number of refuting statements but no results in the analysis of the depth of the argumentative statements. It is difficult to relate the lack of (statistical) evidence about the depth of the argumentative statements to the refutation ability of the writers since the depth construct includes not only the depth of refuting arguments but also the depth of supporting arguments or counterarguments. It is entirely possible that the depth of refuting statements was actually increased but the depth of supporting arguments and counterarguments was not, 'biasing' the statistical test towards no evidence.

To sum up, it is not clear whether the confirmation of Hypothesis 1a is the result of the medium used (computer-based DM) and/or the result of the low baseline in terms of argumentation skills. Moreover it is not clear whether the adoption of more refutation

strategies by this group includes just the increase of number of refuting statements (confirmed by the statistical test) and/or the increase of the depth of the refutation statements.

3.8.2 Study 1b

Hypothesis 1b was not supported by the statistical analysis. There was no evidence that the overall quality or the argumentative structure of the produced essays was better in the posttest compared to the baseline. However a number of factors should be taken into consideration to interpret these results.

The evaluation by the independent rater showed that the paper group essays were of higher argumentative quality than the computer group at the baseline. Moreover the text analysis showed that the paper group integrated less supportive arguments and more counterarguments. Nussbaum and his colleagues highlight the importance of successfully integrating more counterarguments in order to achieve well-developed argumentation (Nussbaum & Edwards, 2011; Nussbaum & Schraw, 2007). In contrast with the computer group, which showed negligible activity in pretest refutation, the paper group showed a good-level activity in pretest refutation as indicated by the comparison of their text analysis results with the Crammond study (1997), with the paper group showing comparable results with the 10^{th} grade students.

The analysis found no evidence of a change between the pretest and posttest essays of the paper group, and no significant change in the overall quality or the argumentative structure of the essay. It is possible that the paper-based application produces a messy representation of the argument structure and does not support effectively the users in reflecting about their position and arguments. Nevertheless the Paper DM does not appear to deteriorate the quality of argumentative essays. Furthermore, the deterioration of the argumentative quality of the

essay as a result of the use of paper-based DM would be in contrast with other studies that have found significant impact of similar methods on the quality of essays (Lin et al., 2004; Nussbaum, 2008; Nussbaum & Schraw, 2007; Yeh, 1998a). In particular, Nussbaum and Schraw (2007, p.59) found that using a paper-based graphic organizer, which organizes arguments and counterarguments in a similar way as the Dialectic Method, increases the number of refuted counterarguments in undergraduate students' essays, producing essays "with stronger rebuttals and more balanced reasoning" (2007, p.59). This was the case even when the paper-based graphic organizer was used over a very short period of time: students were allowed to work with the graphic organizer for 5 minutes and they had to hand it back before engaging in 30 minutes of essay writing. The difference in results between previous studies and this study could be related to methodological issues and more specifically the rather small size of the paper group sample (Table 3.8).

To sum up, it is not evident whether the rejection of Hypothesis 1b is related to the medium used (paper-based DM) and/or the higher starting point in terms of argumentation skills of the subjects. In fact it is entirely possible that the rejection of Hypothesis does not indicate lack of impact for the paper-based DM on the overall quality and the argumentations structure of the generated essays but is it is due to methodological choices made in this experiment, namely the small size of the paper-group.

Although this study has provided with a number of interesting insights, it has also suffered from a number of limitations. Some of these limitations are related to specific choices made during this study (with or without the consent of the researcher) while others are more generic and related to the research strategy adopted by this genre of studies, where the impact is primarily assessed through the analysis of the final essay. These limitations are discussed in the next two sections.

3.9 Limitations of the study

This study was set up as an exploratory study following the tradition of a quasi-experiment taking place in real conditions. Access was secured to two classrooms of the language centre of the University of Birmingham, in order to request the students to use the developed DM tool as part of a writing exercise. However the language centre made clear that the classrooms should participate in the experiment in their current configuration, preventing the possibility of controlling more the composition of the groups in the two conditions (e.g. through a random allocation of students from the same class to the two conditions). As a result, the researcher had no control on the composition or the size of the two groups, a situation often found in quasi-experimental conditions which take place in real conditions such as real-life classrooms. One of the provided classes (the paper-based group) was of rather limited size which in turn imposed some limitations on the possible statistical analysis.

Furthermore during the course of the data analysis the two groups were found non-equivalent in terms of argumentative writing ability. This cancelled the possibility to compare the two groups at posttest.

As a result, the work conducted in these two studies (study 1a and 1b) is exploratory in nature.

Both groups' scores (as measured in the pretest and posttest essay) are rather low in terms of refutation and certainly lower than the refutation scores exhibited by expert writers. For instance, in terms of refutation the two groups are of equivalent or lower level to the final year of secondary school, if compared with Crammond's analysis. However the participants in this study were not native English speakers; they were learners of English for academic purposes coming from Asian and Latin American counties. The origin of these subjects can explain the low scores demonstrated in their essays in two ways. Firstly, such writers often face rhetorical difficulties, as they are influenced by cultural and linguistic conventions of their native

language and culture (Connor, 1996; Ferris, 1994; Zhu, 2009). For example a study conducted with Saudi students of English found that balance in arguments and counterarguments was one of the main difficulties (AI-Abed-AI-Haq & Ahmed, 1994). Organization and development of arguments were reported to be the most difficulty aspect of argumentative writing as perceived by Mexican students (Zhu, 2009). Secondly, these students may both have the schema of refutation but they may lack in linguistic skills for expressing it. Appropriate use of linguistic markers and managing the expression of complex argument structures is known to be a hindrance in written argumentation (Piolat, 1999).

Another limitation was the computer system that was used in the study. The Computer DM is based on a prototype implementation of a diagram editor. Although the prototype is quite stable the interface could be improved. For instance, one limitation of the editor was that entering text in textboxes could not be done by simply double clicking on it; the user had to access a dialogue box every time she wants to enter or edit text. Similarly rearranging textboxes, detaching them and reattaching them in a new place could not be done with direct manipulation but it required an intermediate step through a dialogue box. This is possible to limit the interaction with the diagram editor resulting into small size diagrams. A fully-fledged and more mature software, which supports argument diagramming, would perhaps provide a better base for the use of argument diagramming in the process of writing planning.

3.10 The need for further research

This study has undertaken the approach that the argumentative quality of an essay cannot be assessed only through its overall quality but it also requires a text-analysis that focuses on the argumentative moves within the text. Both dimensions must be assessed to capture the full impact of argument diagramming on argumentative essays. A special text analysis measure was used in this study to enable the analysis to go beyond the overall quality of the essay and

develop insights into the argumentative quality of the text. Although this measure was proved very useful, it has its own limitations. This measure is able to assess the number and the depth of the argumentative moves included in the text but it is not able to assess the depth of argument moves of different orientation separately. The measure cannot also asses the coherence of argumentative text, i.e. the relationship of argument moves with the central position of the essay, for example whether an argument move contributes or contradicts the building up to the position of the essay. A comprehensive and in-depth investigation of the text is required in order to fully understand the argumentative quality of the essays.

This study has highlighted another important aspect of research about argumentative diagramming. In particular the study has highlighted the importance of the initial argumentative ability of the writer when she starts interacting with the actual argument diagramming method (computer or paper-based). In other words an expert or skilful writer is expected to use and interact with the argument diagramming method in a different way from a rather inexperienced or underdeveloped writer of argumentative essays. This puts emphasis on the actual process of using and interacting with the argument diagramming, including dimensions like the time spent on planning, translating or revising, the number of entries in the diagram, and the way the argument diagram is constructed etc. In other words, investigating the impact of argument diagramming on writing cannot be limited to the study of the impact on the generated essay (i.e. the outcome of the process), it should also look at the actual process of using and interacting with argument diagramming.

The investigation of the process of using and interacting with argument diagramming carries its own methodological challenges. This study has attempted to capture some of the process data through asking the subjects to tick a checklist of criteria while they were using the DM. Nevertheless, this method delivered very little results since the writers were in general

reluctant to interrupt the actual process of using the DM in order to provide input to the checklist. This argues for additional methods to capture process data that are less intrusive and allow the research to capture data without interrupting the writer (such as video recording, think aloud procedures etc.)

Finally, following the recent emphasis of theory on argument schemata (Graham & Harris, 2009; Nussbaum, 2011) where the importance of the writer's mental representations is highlighted, the impact of argument diagramming should be sought not only on the cognitive aspects of writing (the actual process and strategies deployed by the writer) but also on the meta-cognitive. For instance, according to Yeh (1998a) gains in quality of middle-school students' essays were identified in relation to development of claims in depth, using supporting arguments, and clear expression of position. However, the most prominent gains of the intervention were related with improved awareness about argumentative strategies and criteria of good argumentation. One more study has identified improvement in writer's perception about critical thinking after using a computer-supported argumentation tool (Carrington et al., 2011). Further research is needed to investigate whether and how argument diagramming impacts the metacognition of the writing process, influencing the perceptions and the awareness of writers about writing.

3.11 Concluding remarks

This chapter reported on the first studies undertaken in this research project which investigated whether the argument diagramming administered as a paper-based and computer-based method improves significantly the quality of argumentative essays. Evidence was found that the argument diagramming increases the overall quality as well as the refuting statements in argumentative essays, at least when it is administered as computer-based method.

The study produced a number of competing interpretations explaining the identified impact of argument diagramming. To understand better the mechanisms of and the reasons behind the impact of argument diagramming on argumentative writing, further investigation is needed. A new study was set up (study 2) to explore in-depth the impact of argumentative diagramming on the generated text. Furthermore process data are required to explore the way that the initial argumentation quality of the writer interacts with argument diagramming in order to generate the final impact of the method on the (cognition of the) writing process. The potential impact of argument diagramming on metacognitive aspects of the writing process (such as the awareness about own argumentative quality) should be studied in order to identify the full impact of argument diagramming on the argumentative writing.

Given the scarcity of contributions on these topics, a qualitative analysis approach is deemed as more appropriate to investigate these issues. The non-ideal conditions experienced in this study should be taken into account, so to avoid similar issues in the next study. Firstly a higher degree of control should be pursued on the experimental conditions of the new study. For instance the research should have more freedom to randomly allocate the subjects to different conditions and different essay topics. Secondly to avoid the intervening effect of language proficiency, only native speakers will be recruited to participate in the new study. Thirdly to avoid the intervening effect of the system maturity, a well-established argument diagramming system (already in the market) will be selected as the computer-based method. Finally the process data will be collected through a range of methods to ensure that less intrusive methods are used, increasing hence the chances of collecting a critical mass of process data. Next chapter describes in more detail the set up for the experiment of the second study as well the methodology for the analysis of the collected data.

Chapter 4 Study 2: Rationale and methods

4.1 Rationale of study design and methodology

The previous chapters investigated the impact of argument diagramming on text. In particular, the investigation focused on the quality of essays written after argument diagramming was employed as a pre-writing strategy on paper or on computer. Study 2, described in this and the following chapters, shifts the focus of investigation to examine the impact of argument diagramming on the argumentative writing process. Specifically the new research question being investigated is: "*How does argument diagramming as a method of supporting the planning of argumentative essays affect the cognition of argumentative writing process and the quality of argumentative text?"* In the context of investigating this research question, cognition of the writing process refers to goals, processes and strategies a writer employs in order to plan and integrate argumentation in a text. Such text develops opinions and issues about a controversial topic, expresses the writer's position, and attempts to influence the reader's representation about them (Andriessen & Coirier, 1999). *Argument diagramming* is considered here as a pre-writing method employing a diagram notation for representing argumentation structure components and links. Argument diagramming (or argument mapping) is a mapping technique used to represent the structure of argumentation and specifically how elements of this structure, such as claims evidence, supporting and opposing relations, are used to represent a debate (Okada et al., 2008). In this context argument diagramming notation has been expanded and formalized in many ways. In this study the notation of the argument diagramming software *Rationale 2* ™ (http://rationale.austhink.com/) is used, and an equivalent notation for practicing argument diagramming on paper adopting similar constraints and colour annotation.

It is possible to approach writing planning cognition from two perspectives. First, from the point of view of practices, that is the actual *cognitive process and strategies* that can be inferred through observing the writer on task and analysing intermediate and final products, such as plans or drafts and final texts. Second, the *writers' metacognitive awareness* about the processes and strategies; this can be investigated by eliciting the writer's own awareness about goals, process and strategies involved in constructing intermediate and final products of writing.

Thus, study 2 investigates how the use of argument diagramming, both computer- and paper-based, changes the goals and practices of planning and composing argumentative essay, and impacts the awareness about the planning and writing processes. The change of argument planning cognition is analysed with reference to changes identified in the generated text. The study participants are 16 first-year undergraduate students who voluntarily took part in a 7 hour long study and received a fee upon completion. A pre-post design (within groups comparison) was adopted in order to compare writers' baseline goals and planning and writing practices with those adopted when using an argument diagramming method on paper or on computer. The comparison is done on the basis of online observed practices during planning and composing and on reported accounts of writer's own goals, practices and difficulties. A computer versus paper comparison is also carried out to investigate differences in planning and linearizing practices between the participants who used the software *Rationale 2*™ and participants who used an equivalent method on paper.

In order to differentiate between the pre and post phases, in this and the following chapter the pre phase will be referred to as baseline and the post as argument diagramming phase. There are also two conditions, the paper and the computer. The participants took part in the study individually not as a group as in studies 1a and 1b. As it is explained in this chapter, some

decisions were taken in order to secure balanced samples, and control for confounding variables, such as the order of essay topic. Nevertheless the work undertaken follows an exploratory approach, seen often in qualitative studies, rather than an approach of a fully controlled laboratory study.

The data captured and analysed include:

- the essays of participants written on two controversial topics at baseline and one at argument diagramming phase.
- the intermediate plans and outlines produced at baseline and argument diagramming phases,
- the process of planning and writing captured on video and think aloud protocols,
- and interviews taken after each participant complete the baseline and posttest essay.

4.1.1 Structure of methodology chapter

The changes, improvement or deterioration, identified in the argumentative essays between the baseline and argument diagramming phase are investigated because they are important point of reference for the other changes, i.e. the change in process and the change in awareness. Section 4.3 describes the essay analysis methodology which investigates changes in written argumentation strategies. In order to avoid bias, the analysis of essays, undertaken by the writer of the thesis, was carried out blindly to the participant's identity, baseline or argument diagramming phase and paper or computer condition.

Section 4.4 describes the analysis methodology of investigating changes in planning and writing process. The process investigation is based on analysis of think aloud talk, video transcripts capturing planning and writing activities, and planning products, such as notes and

diagrams, produced at both phases. A comparison between the baseline and the argument diagramming phase is conducted.

The method for collecting the interview data is presented in Section 4.2.10 while the method of interview analysis is presented in chapter 6.

Section 4.2 presents data collection instruments and methods and issues related to the design of the study. Section 4.3 presents in detail the method of analysis of essays and Section 4.4 the analysis of process data.

4.2 Design of Study 2

4.2.1 Participant recruitment

An electronic invitation to participate in a study on essay writing for English native speakers was sent out to all first-year undergraduates of the University of Birmingham during the latter part of the academic year (March 2010). The invitation informed the students about the nature of the study and the compensation (30 GPB) they would receive once they complete a 7 hour-long study over 3 days.

Out of the 32 who responded to the e-mail, the first 16 students were involved in the pilot phase, and the 16 who responded, were scheduled to participate in the main study). The latter 16 participants, 5 males and 11 females, were randomized to 4 groups (computer group essay topic A, computer group essay topic B, paper group essay topic A and paper group essay topic B) using a web based random assignment tool[1] (Table 4.1).

The ideas and beliefs that people hold about knowledge and knowing, in other words their epistemological beliefs, are influenced by their academic experiences and may also affect

[1] Quickcalcs on http://www.graphpad.com/quickcalcs/randomize1.cfm

their critical thinking skills (Hofer, 2001). Although many studies refer to the value of generic skills in argumentation, argumentation differs across disciplines (Andrews, 2010). As shown in Table 4.1, the 16 participants came from a variety of disciplines and this is possible to affect the approach they took when they engaged in argumentation.

4.2.2 Argument diagramming editor

The software package *Rationale 2* ™ was used[2] to support the computer-based practice in argument diagramming (Figure 4.1). The argument diagram editor was chosen for three reasons: First, it supports construction of argument diagrams that resemble those of the dialectic method used in study 1a and 1b. Second, the diagram notation of Rationale, and its predecessor Reason!Able, was designed to support the development of critical thinking skills.

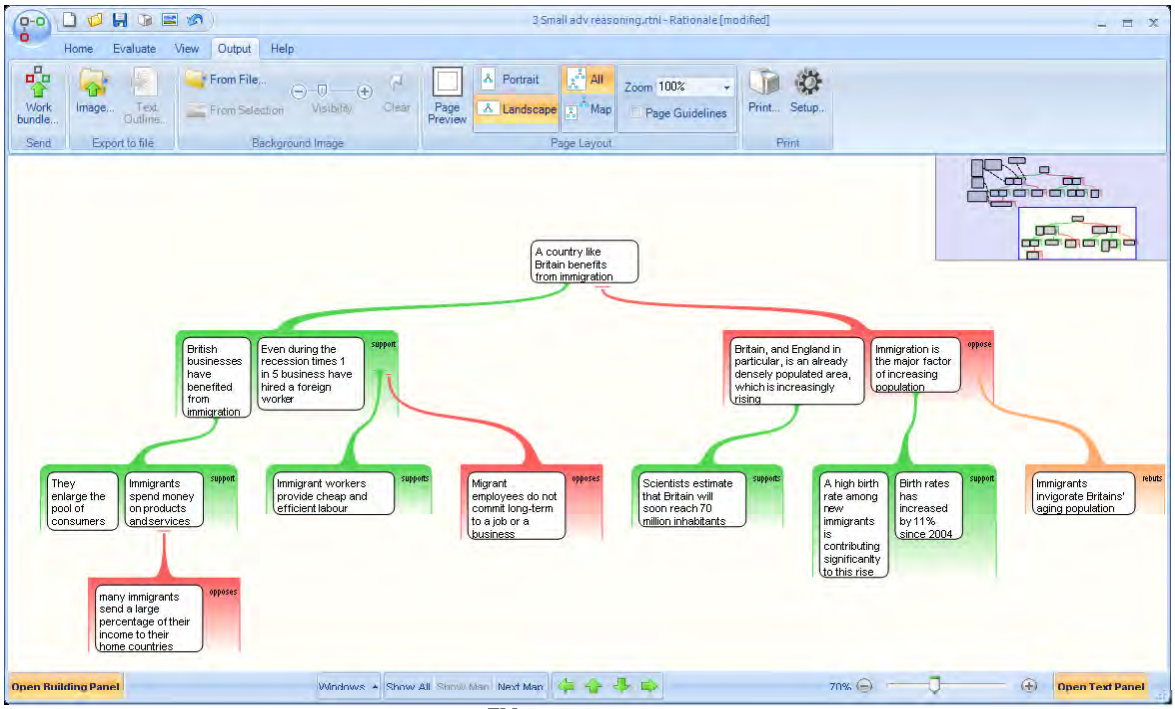


Figure 4.1: Screen shot of Rationale 2 ™

[2] http://rationale.austhink.com/

It is the outcome of many years of research at University of Melbourne and commercial development. It draws on the analytic models of argument but also integrates the dialectic dimension. Third, Rationale is commercial software which has already been used in a number of published studies (Carrington et al., 2011; Rider & Thomason, 2008; van Gelder, 2003) to support the development of critical thinking skills. As such there are limited usability issues.

4.2.3 Task

Each participant completed the study independently and received individual instruction by the experimenter. The study consisted of two writing sessions, writing task I (baseline), writing task II (argument diagramming), and a training session in argument diagramming in between (Table 4.2). After each writing session the participants were interviewed. Before starting the writing task the participants were asked to practice thinking aloud while drawing the blueprint of their house on paper and then to compose a paragraph about whether smoking should be banned in public. Twenty minutes were allocated for practicing thinking aloud.

Baseline: All participants were asked to write their first essay (baseline) following their usual planning strategies, and produce a text of up to 1300 words in 2 hours, including time for planning or drafting.

Training: All participants were individually introduced to using either the paper-based or the computer-based planning method, according to group allocation, with demonstration and hands on exercises (1 hour). Then they were given one more hour to practice the diagram method. They worked on building an argument diagram on the same topic they write the baseline essay on and they also reported how they would linearize the diagram in text

Participants	Name[3]	Age	School	Baseline essay topic	condition
P1	Fern	19	Political science and international studies	A	PC
P2	Billy	18	Mathematics	A	PC
P3	Rea	19	Sociology	A	PC
P4	Shaun	21	English Literature and Philosophy	A	PC
P5	Harriet	18	School of Geography, Earth and Environmental Sciences	B	PC
P6	Ann	18	Biological Sciences	B	PC
P7	Mary	19	Classics, Ancient History and Archaeology	B	PC
P8	Charlie	19	Electrical and Electronic Engineering	B	PC
P9	Harry	20	Economics	A	Paper
P10	Fiona	19	Political science and international studies	A	Paper
P11	Sheila	19	English Literature and Philosophy	A	Paper
P12	Diane	29	Social sciences	A	Paper
P13	Pandora	19	Biosciences	B	Paper
P14	Liana	19	Biosciences	B	Paper
P15	Deana	19	Political science and international studies	B	Paper
P16	Anthony	19	Mathematics	B	Paper

Table 4.1: List of participants and group allocation

[3] Pseudonym

.

Baseline n=16	Practicing in applying thinking aloud protocol	20-30 minutes	The participants are asked to think aloud while drawing the blueprint of their house or flat and writing a paragraph on what they would do if they had 10.000 pounds
	Writing Task I (1300 words)	2 Hrs	Essay topic A or B is randomly assigned. No advice on planning is instructed.
	Interview	20 minutes	The participants are interviewed regarding their difficulties with argumentative writing and usual and current process in formulating argumentation structure while planning or composing.
Training in argument diagramming: Random allocation to Computer group (n=8) or Paper group (n=8)	Introduction to using the method (either on paper or on computer)	1 hour approx.	Similar steps and identical examples are used in training the paper and computer group. The introduction is given individually to each subject by the experimenter.
	Practice on building a diagram	1 hour	The participants are requested to draw an argument map on the topic of Writing Task 1.
Argument diagramming Computer group (n=8) or Paper group (n=8)	Writing Task II (1300 words)	2 Hrs	The second topic, A or B is assigned. The participants are advised to use the diagram method, on paper or on computer, depending on their allocated group.
	Interview	30-40 minutes	The interview focus on impressions about the planning method, gained knowledge about planning and linearizing strategies, and change in attitude regarding difficulties with argumentative writing.
Total	7 hours approximately		

Table 4.2: Design of Study 2

Argument diagramming: The participants were asked to write an essay of similar length on the second topic and use the diagram method, either on paper or on computer, depending on the group they were allocated to. They had 2 hours to complete.

Interview: All participants were interviewed twice. First, right after they wrote the baseline argumentative essay and secondly after they finished writing the second essay. The semi-structured interview lasted on average 20 minutes after the baseline essay, and 30 minutes after the posttest essay.

4.2.4 Essay topics

The topics are believed to raise issues that most participants are familiar with (Table 4.3). The participants were not given access to relevant content, e.g. articles, before composing the essays.

All participants wrote an essay on each of the following topics A and B. Following a random allocation 8 participants were assigned to write on topic A and 8 on topic B. The topics were then reversed for the posttest essay (See Table 4.1 for allocation of participants to topics).

Topic A: Nowadays people use more and more the internet and specifically what is called social networking tools in their social life. Websites, like the Facebook, reach record high visits every day. Should people use the internet to build relationships or not? Where do you stand in this debate?
Topic B: There is an on-going debate about whether undergraduate students should pay tuition fees. Should students in higher education be charged tuition fees or not? Where do you stand in this debate?

Table 4.3: Topics assigned to participants in baseline or posttest essay

4.2.5 Training in argument diagramming

The finalisation and testing of material used during the introduction of participants to the diagramming method and practice (training session), took place during the pilot studies. After many iterations and revisions it has been decided that the participants should be gradually introduced to the use of the diagrammatic method, following the same scripted steps, on paper or on computer group, with the guidance of the experimenter and hands-on exercises and practice (the steps and material used during the computer-based training are included in Appendix VI, p.428). For example, after being introduced to the basics of the diagram notation the participants were asked to assemble a diagram on the screen, thus they become familiar with both the software and the notation. A similar exercise was designed for the paper group, providing paper cuts and markers. In the end they were asked to produce a diagram plan from scratch relying on the content of the baseline essay.

4.2.6 Experimental set up

While each participant was left to work alone, the experimenter was sitting in the same room behind a panel (Figure 4.2 and Figure 4.2). The experimenter could observe the process of the participants on screen, respond to participants' questions but also supervise the recording of the process, making sure that online data were captured on video from various sources. Observing the process in real time allowed the observer to gain an overall idea about the process of the participant which informed the discussion during the interview.

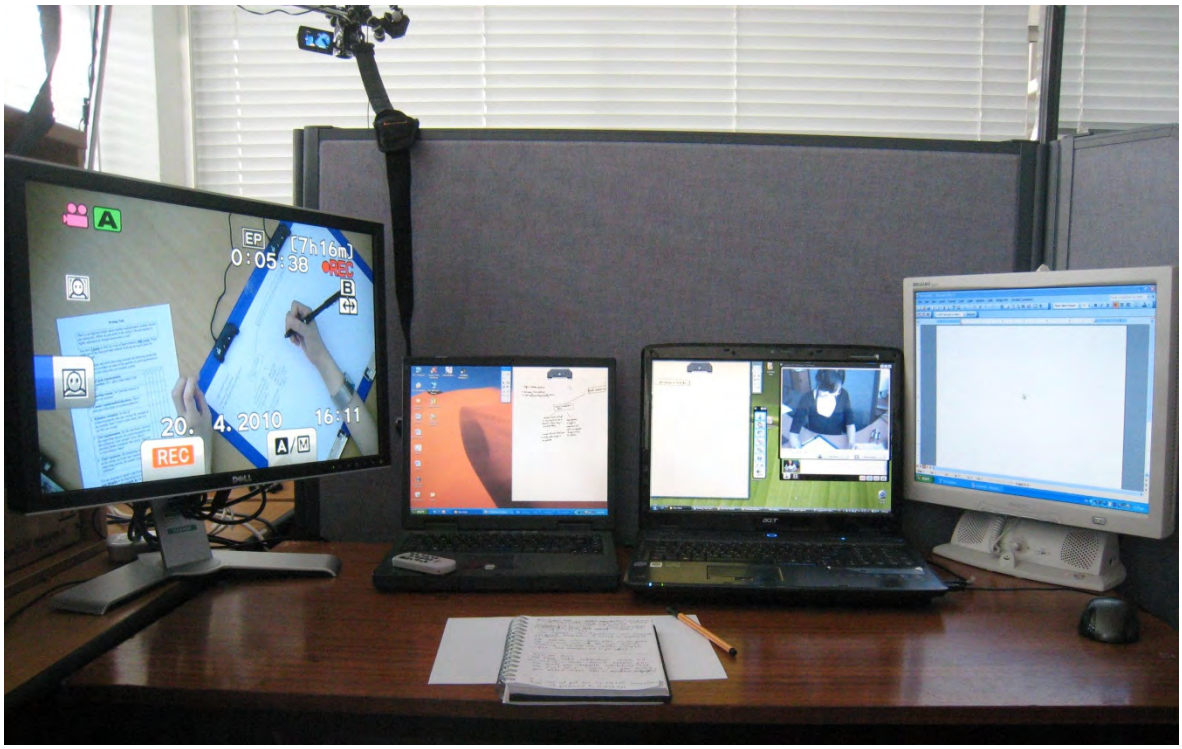


Figure 4.2: Experimenter's position during data capture

Figure 4.3: Participants position during the study

4.2.7 Think aloud talk as process data

Think aloud data, known to provide insight in the process of planning and writing (Smagorinsky, 1994), were collected at two instances, while the writers wrote the baseline essay and the posttest essay. Think aloud protocols are considered a valuable method for collecting process data (Kuusela & Paul, 2000; Ransdell, 1995) despite criticisms about disrupting the process of writing (Janssen, van Waes, & van den Bergh, 1996).

4.2.8 The 6 point criteria list

In order to collect online data that could inform the formulation of argument structure, the participants were given a 6-point list referring to aspects of argumentation structure, and were asked to tick next to each item whenever they consider it, during planning and writing (Table 4.4). The list is suggesting the principles of integration of arguments and counterarguments, of formulating and supporting a position as well as refuting counterarguments.

The aim of using this list was twofold: First, it allows capturing data about when the participants were actual ticking off an item, how often, and after what sequence of actions. This can enhance the data gathered from think aloud protocols. Second, the list introduced a set of specific goals for the writing task defining what is expected regarding the argumentation structure. Specific goal instruction, such as to generate counterarguments, is found to have positive impact on writing, in comparison to general goals such as to persuade the reader (Ferretti et al., 2000; Nussbaum & Kardash, 2005). However, the aim of the list is not to test the effect of instructing goals. The list communicates to participants the requirements of the writing genre in which they were expected to compose, thus unifying the representations of the task amongst the participants, who were coming from difference course and schools of the university. Third, as it became evident during the pilot discussions,

reference to the ticked or non-ticked items enriched the discussion about the difficulties and strengths of the participants during composing (in the interview the participants were asked to report which item they found more difficult and easy to tick).

Criteria of good argumentation	√	√	√	√	√
***Clear position*.** Do I take a clear stand in the debate?					
Supporting reasons. Do I provide reasons to support my position?					
Counter argumentation (objections). Have I presented objections or counterarguments?					
Refutation (rebuttals). In view of counterarguments, that may weaken the strength of my position, have I tried to refute them, that is, to say they are wrong?					
Clear argumentation. Are the statements I present, the supporting reasons, the counterarguments and the refutations, clear enough? If not, have I provided further statements that clarify, illustrate or even enhance them?					
Final conclusion. On formulating my conclusion in this debate, do I take into consideration the supporting reasons, the counter argumentation and refutation?					

Table 4.4: Criteria list

4.2.9 Capturing process data on video

Many technical issues regarding the capturing and synchronising of video streams were resolved during the pilot tests. Video data were captured from three aspects: a) a bird's eye view, capturing gestures and activity on paper, such as when the participant is planning the essay on paper during the baseline phase (Figure 4.4 A) or doing a diagram plan on paper during the argument diagramming phase (Figure 4.4, B) b) a screen capture view, where we can follow the participant's writing process on the computer screen and c) the face view, capturing the face and gestures of participants and the moments they turned to the screen or the paper sheets. The three views were later synched in one video stream to facilitate analysis (Figure 4.4 C and D).

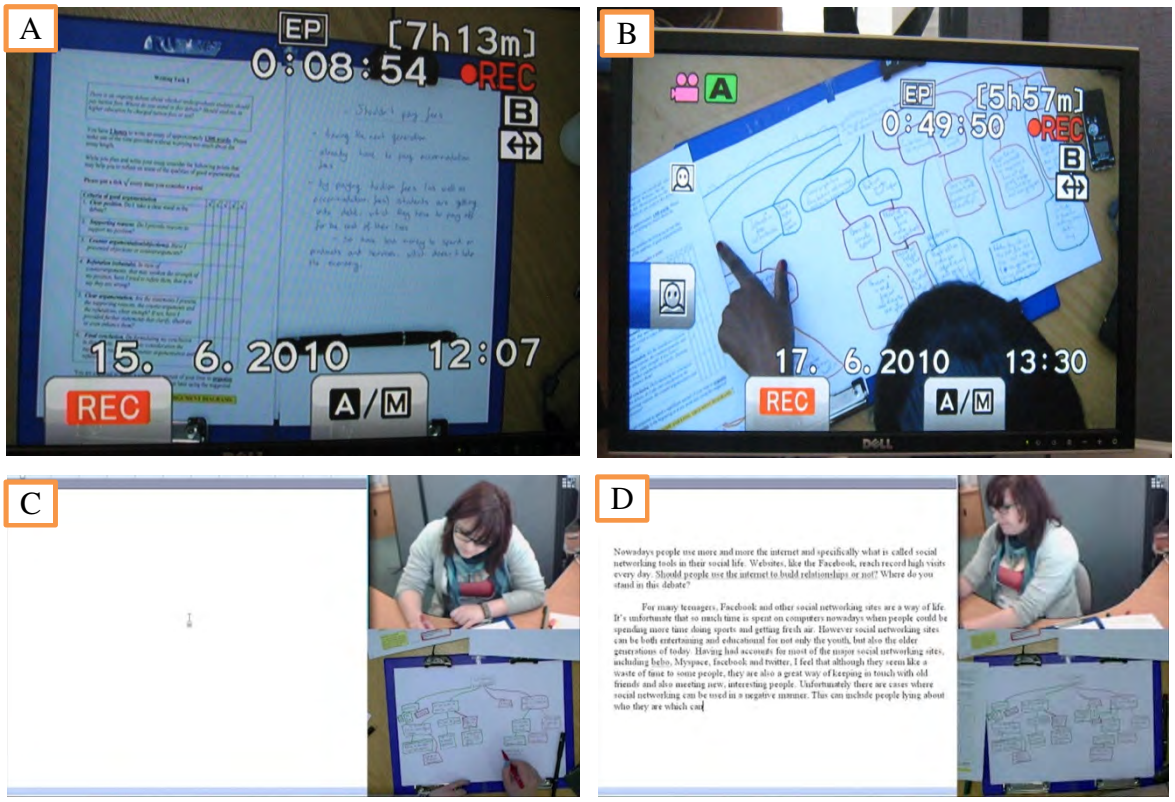


Figure 4.4:. Streams of process data captured on video

4.2.10 Interviews

A semi-structured interview was conducted immediately after completing the baseline and posttest essays with all participants. The structure of the baseline and the argument diagramming interviews was similar, although the argument diagramming interview included more questions and tended to last longer (See Appendix IV and Appendix V).

In the *baseline interview*, after a couple of warming up questions, such as what the participant thought about the topic and whether argumentative essays were assigned during their first year at university, the first part of the interview focused on the participant's attitude towards argumentative writing, the perceived difficulties and strengths, and the remarks the participants usually receive regarding their argumentative essays. In the second part, the questions focused on planning strategies. In particular, each participant was requested to give an account of the process he or she followed while planning the essay. Segments of the participant's captured video were used as a stimuli of recall during this part of the interview (Gass & Mackey, 2000), as well as the plans. Additionally, the participant was offered the opportunity to use segments of the captured video, or the produced plan and text, to clarify or elaborate his or her account of the process. The participant was then asked whether the given account was representative of the usual planning strategy and if not was asked to elaborate. Then, in order to shift the focus to argumentation, the interviewer would drew the attention to the item that was least ticked and mostly ticked on the list, asking from the participant to name the item of the list he or she find most difficult to tick, and why. In the third part of the interview, each participant was questioned about their linearization process, how the plan helped to write the essay and how they ordered and organised the content of the plan in the essay. As in the previous part, they were asked again which point of the item they find more difficult to tick during writing the essay.

The *argument diagramming interview* followed similar structure and questions adding a few further questions about the diagramming method. In the first part of the argument diagramming interview, there were a few general questions regarding the topic, and a request to give a first impression about the diagramming method. Often the latter was enough to start a vivid discussion. In the second and third part, the participants were asked about how they used the diagram to plan and then how the diagram helped them to write the essay. Similarly to the baseline interview, reference to the item that was least and mostly ticked was made, and the participants were encouraged to discuss. The fourth part of the interview was quite important as it elicited the participants view about the advantages and disadvantages of the diagramming method. Crucially, the participants were asked to compare their process of essay writing before and after using the diagramming method. Furthermore, they were asked to define if and what they learned from using the diagramming method. Finally they were asked to recall what they had previously, in the baseline interview, mentioned as a difficulty and discuss if and how the method helped them to improve.

4.3 Essay analysis methodology

4.3.1 Theoretical rationale

Studies 1a and 1b measured the quality of argumentative writing through the existence of basic argument moves, support, counter and refuting moves. Study 2 explores the impact of argument diagramming on a wider range of strategies. Refutation is the least integrative strategy if used on its own. This is because, although arguers examine arguments from both sides, they do so to defend only one of them (Graham & Harris, 2009; Nussbaum, 2008; Nussbaum & Schraw, 2007; Nussbaum et al., 2007). It is also suggested that if the refutation strategy is used together with the weighing strategy and with a synthesis strategy, the

refutation strategy would not weaken the integrative quality of the approach (Nussbaum, 2008).

The essay analysis methodology in study 2 is a bottom-up analysis deployed at 3 levels. It starts with (1) the Rhetorical Structure Theory (RST) at lower level, draws on this level to (2) infer argumentation schemata, and (3) concludes at the top level to aspects of text change for each of the 16 participants, after the posttest essay is compared with the baseline essay. The 3 levels of analysis are completed in the order given above. In order to avoid bias during the essay analysis' levels 1 and 2 of the analysis of essays is carried out blind to writers' identity and phase (baseline or argument diagramming).

Rhetorical Structure Theory (RST)

Rhetorical Structure Theory (RST) (Mann, Matthiessen, & Thompson, 1992; Mann & Thompson, 1988) is a discourse analysis theory and methodology that represents text coherence "by postulating a hierarchical, connected structure of texts, in which every part of a text has a role, a function to play, with respect to other parts in the text" (Taboada & Mann, 2006b, p.425). Relations are systematically coded between text spans following rules and definitions (Mann et al., 1992). The analyst establishes relations between a *nucleus*, containing important information without which the relation would not make sense, and a *satellite* that contains information about the nucleus. These are called coherence relations. Mann and Thomson (1988) introduced a set of relations, which were later expanded by other researchers (e.g. Carlson & Marcu, 2001; Marcu, 2000) .

RST is a rigorous, systematic and widely applied discourse analysis method that has moved beyond its initial objective of text generation since its original conception in the 80's. Tabaoda and Man (2006a) conclude in their review that RST is used as a conceptual starting

point in various projects across several fields. In computation linguistics it has been used for automatic summarisation of text, language translation, argument evaluation, and essay assessment. Azar (1999) argues that RST is valuable in analysing argumentative texts, as the distinction between nucleus and satellite is crucial for understanding argumentation structure. Regarding the evaluation of participants' argumentative essays RST was used in order to detect coherence errors of low-intermediate learners of English and provide bottom-up coherence analysis (Skoufaki, 2009). In another interesting study RST is used to investigate the process of text generation, from planning to writing, by looking into think aloud protocols of naïve writers (Torrance & Bouayad-Agha, 2001). The structure of protocols is then compared with the final text to shed light into the process of writing.

An issue of application of RST is the validation of the analysis, although validation by a second rater is not common in linguistic analysis that aims to describe text structure. Validation of analysts' agreement is reported when constructing a corpus of discourse trees, or a distinct set of definitions and guidelines for annotating RST (Marcu, Romera, & Amorrortu, 1999). For Taboada and Mann (2006b) high consistency in analysis comes as result of following "the creation of solid guidelines, so that the decisions made in the analysis are explicit and reproducible" (p. 444). Marcu et al. also posits that ". . . even simple, intuitive definitions of rhetorical relations . . . and discourse structure can lead to reliable annotation schemata" (1999, p. 55).

Studies 1a and 1b also used a measure of argument structure complexity, applied as discourse structure analysis method (Crammond, 1997, 1998). However, in Crammond's model (1997, 1998) argument structure is defined only in terms of a modified and elaborated Toulmin model, consisting of claim, data, warrant, and rebuttals, thus constraining the representation of argument strategies to counterargument and refutation only. The current analytical rationale

posits that in order to identify a wider range of textual phenomena a more generic approach to textual analysis is needed. Azar (1999) also argues in favour of an argumentative text analysis framework that is independent to the specifics of argumentation theory and suggest to start from a text generic analytical framework before moving to argumentation analysis specifics. Strategies such as weighing, minimization, synthesis which are used for integrating arguments and counterarguments cannot be captured with Crammond's analytical model.

Furthermore, Crammond's model (1997, 1998) did not capture non-functional elements of argumentative essays either, such as repetitions, unrelated statements, topic drift or digression, which play an important role in text coherence.

Piloting RST for argumentative text analysis

In order to become familiar with annotating the structure of argumentative texts the analyst applied RST analysis to texts proposed by Nussbaum (2008) as reference for coding argumentation strategies in essays. The analyst also piloted the analysis with 3 essays produced during the pilot phase of study 2. During this practice it was considered how argumentation strategies such as *refutation, weighing, synthesis and minimization* can be represented as schemata in RST. These strategies are argument and counterargument integration strategies which are important in order to critically assess and formulate a position. Employing such strategies is widely appreciated as part of writing argumentative or persuasive essays and overcoming one sided (myside bias) approaches (Coirier, 1996; Graham & Harris, 2009; Nussbaum, 2008; Piolat, 1999; van Eemeren & Grootendorst, 1994a)

This practice and pilot analysis confirmed that most of the under investigation argumentation strategies (refutation, weighing etc.) are possible to be coded using the known RST relations. A limited set of new relations were introduced and defined on the basis of existing RST

relation. The practice and pilot analysis also helped to identify an RST relation that defines each argumentation schema. For example a new relation was introduced to code the minimization rhetorical strategy and denote the existence of weighing-minimization schema in an essay. As result of the pilot analysis and subsequent practice guidelines and examples were set for each argumentation schema. These were systematically applied during the analysis of the 32 essays of the study. Argumentation schemata and their defining relations are given below.

4.3.2 Analytic procedure Level 1: Application of RST analysis

The analysis of the 32 essays starts with the segmentation of each essay in elementary discourse units (EDU). An EDU is the 'minimal building block' of analysis which largely coincides with a clause (for a set of rules on EDU segmentation see Carlson & Marcu, 2001, pp. 3-32). Besides the seminal paper of Mann and Thompson (1988, cited over 3000 times), the RST analysis applied in study 2 relies on two further resources that include detailed instructions, rules and examples for applying RST and manually annotating the discourse structure of text. The first is the 'Discourse Tagging Reference Manual' (Carlson & Marcu, 2001 http://www.isi.edu/~marcu/discourse/tagging-ref-manual.pdf), which includes detailed definitions and analysed examples of passages illustrating the use of 78 coherence relations. The second is the Rhetorical Structure Theory website (Mann & Taboada, 2005 http://www.sfu.ca/rst/index.html) which, besides relation definitions, examples, publications and tools, includes analyses of whole texts, and crucially argumentative texts.

While it is possible to apply a wide range of relations, the current analysis involved mainly a subset of these, which are more relevant to argumentation, for example: Antithesis, Background, Concession, Condition, Contrast, Elaboration, Evaluation, Evidence,

Enablement, Example, Justify, Motivation, Cause, Restatement, and Solutionhood. Furthermore, three new relations were introduced to represent argumentation schemata.

According to RST, relations hold between a *nucleus* (N) and a *satellite* (S). Furthermore a relation definition includes 4 fields:

l. Constraints on the Nucleus,

2. Constraints on the Satellite,

3. Constraints on the combination of Nucleus and Satellite,

4. The Effect.

Throughout the analysis the analysts makes judgements about the writer (W) and the reader (R), interpreting the writer's intention or the reader's disposition or reaction, which are defined in either the nucleus or satellite in their semantic combination. As such judgments cannot be certain they are termed plausible judgements. In the Effect field "the analyst effectively provides plausible reasons for why the writer might have included each part of the entire text" (Mann & Thompson, 1988, pp. 245-246).

Examples on the application of RST in the analysed essay are given below with the relations 'evidence' and the 'justify' (drawing on the instructions of Carlson & Marcu, 2001; Mann & Taboada, 2005; Mann & Thompson, 1988) which were commonly used in the analysis of essays for study 2.

relation name: EVIDENCE
constraints on N: R might not believe N to a degree satisfactory to W
constraints on S: The reader believes or will find it credible
constraints on the N + S *combination:* R's comprehending S increases R's belief of N
the effect: R's belief of N is increased
locus of the effect: N (Mann & Thompson, 1988, p. 251)

"Evidence is data on which judgment of a conclusion may be based, and is presented by the writer or an agent in the article to convince the reader of a point. An evidence satellite increases the chance of the reader accepting the information presented in the nucleus." (Carlson & Marcu, 2001, p.58)

Relation Name	Nucleus	Satellite
Evidence	a claim	information intended to increase the reader's belief in the claim

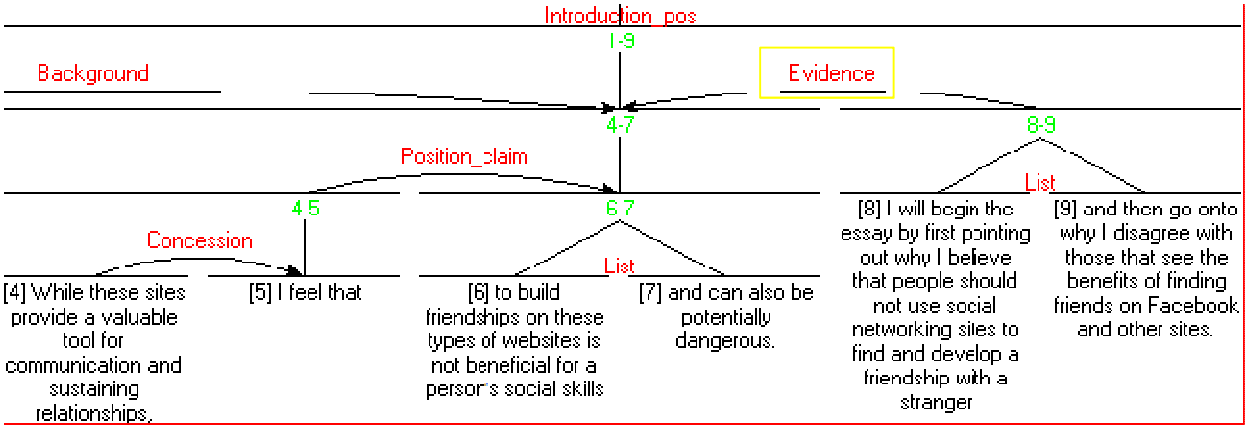


Figure 4.5: Example of RST evidence relation from baseline essay of P1 (Fern)

The passage of Figure 4.5 comes from the introduction of the essay where the participant states her position (EDUs 5-7). In order to increase the reader's belief in her position she explains how the structure of her essay will support her position (EDUs 8-9).

Relation name: JUSTIFY
constraints on N: none
constraints on S: none
constraints on the N +S combination : R's comprehending S increases R's readiness to accept W's right to present N
the effect: R's readiness to accept W's right to present N' .

The passage of Figure 4.6 comes from a paragraph of the same essay (as the passage of Figure 4.5). The writer 'justifies' with EDU 75 the counterargument of EDUs 73-74, but her intention is not so much to convince about the truth of the counterargument. Instead the

writer's intention is to include the counterargument so as to refute it with the following EDU's 76-79.

Relation Name	Nucleus	Satellite
Justify	text	information supporting the writer's right to express the text

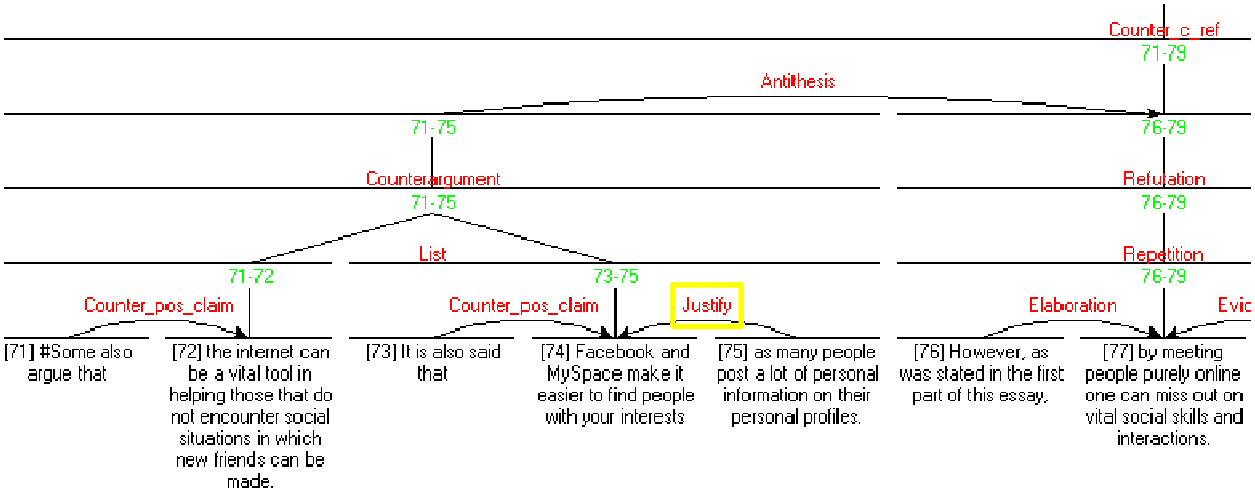


Figure 4.6 : Example of justify relation from baseline essay of P1 (Fern)

Refutation schema

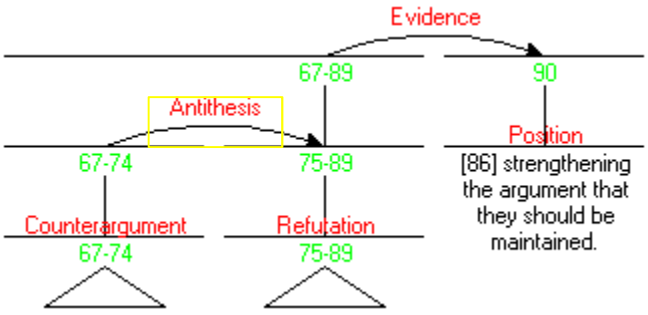


Figure 4.7: Refutation strategy extract analysed with RST relations (Fern P1 posttest essay)

A writer applies a *refutation strategy* to show that one or more counterarguments to the position are false, irrelevant, or insufficiently supported. The refutation schema is always attached to a counterargument schema with an *antithesis* relation. Following the definition of

RST antithesis relation, the counterargument being the satellite (Figure 4.7 EDUs 62-74), and refutation being the nucleus (Figure 4.7 EDUs 75-89), after reading both the satellite and the nucleus, the reader's belief in the nucleus should be increased: "comprehending S and the incompatibility between the situations presented in N and S increases R's positive regard for the situation presented in N" (Mann & Thompson, 1988, p. 253). Thus a counterargument schema is related to the refutation schema with an antithesis relation (Figure 4.7). A refutation schema is always attached to a counterargument schema. The expanded content of Figure 4.7 is gradually presented in Figure 4.8, Figure 4.9, and Figure 4.10.

Figure 4.8 shows the overall structure focusing on the counterargument (EDU 67) and refutation (EDU 89) main statements (keeping the supporting statements collapsed to reduce size). Figure 4.9 shows the counterargument schema expanded. *Counter_pos_claim* (Counter position claim) is a relation introduced for the purpose of the analysis to denote the main statement of the counterargument and define the counterargument schema. This relation introduces a statement that counters the position of the essay. It is defined on the basis of the attribution relation (Carlson & Marcu, 2001) but with an argumentation specific function. Attribution is a rhetorical relation used to introduce direct or indirect speech. The satellite is the source of attribution, i.e. the subject of attribution verbs, such as say, tell, state, announce, declare, suggest, advise report etc. The compliments of these verbs is the nucleus, the content of the reported message, which is a separate EDU (Carlson & Marcu, 2001, p. 45).

relation name: COUNTER POSITION CLAIM
constraints on N: N presents a statement that introduces an opposing or alternate opinion to the writer's own position in the essay
constraints on S: S presents the source of the reported statement
constraints on the N +S combination : R understands the existence of a claim that is opposing or different to the W's position.
the effect: R's comprehends the situation presented in N may undermine W's position .

Figure 4.10 shows the refutation schema expanded over two rows. It consists of a top statement EDU 89, and several sub trees (EDU 75-79, 80-81, and 82-88) which jointly provide evidence to the top statement. It is worth noting that in this example the writer concludes by relating the refuted counterargument with her position argument in order to 'strengthen' it. (Figure 4.10- EDU 90).

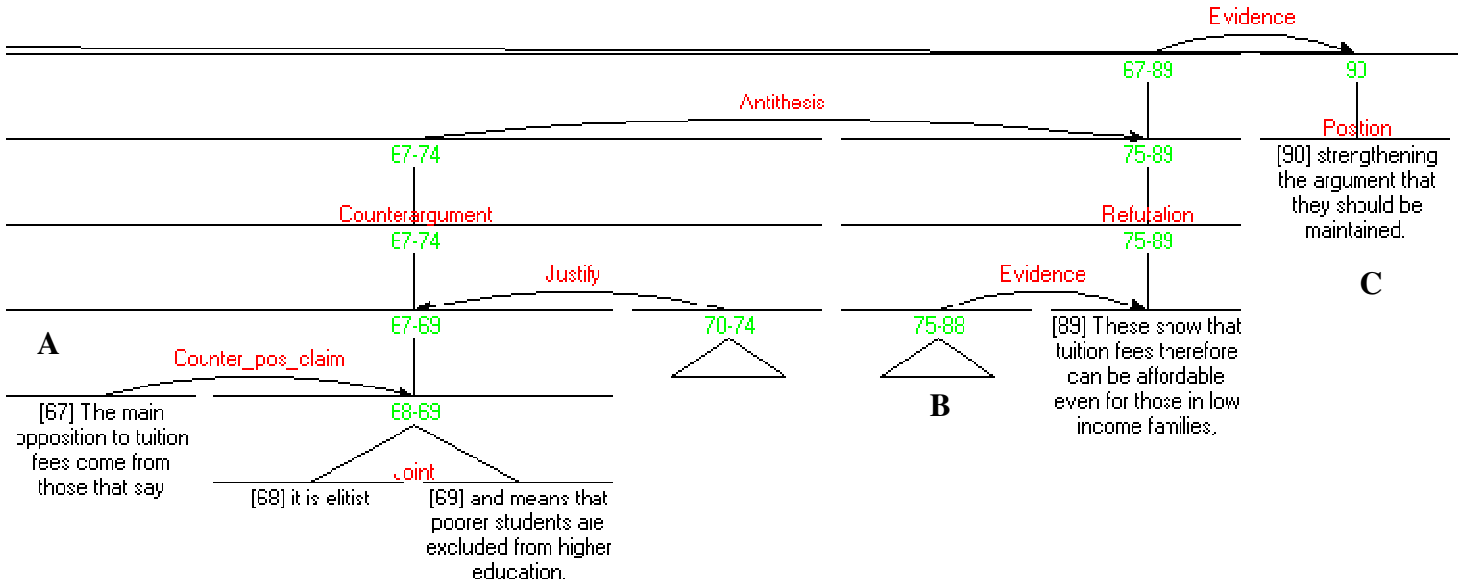


Figure 4.8: Overall structure of refutation schema attached to the counterargument schema through the antithesis relation (Fern P1 posttest essay).

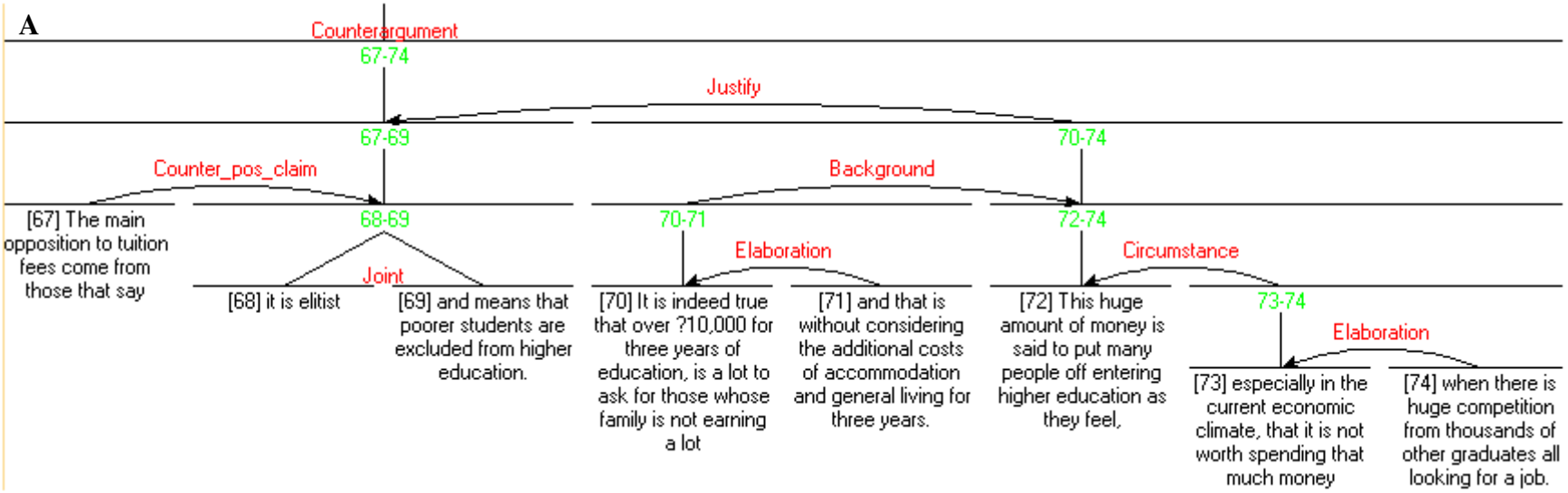


Figure 4.9: Expanded counterargument schema (Fern P1 posttest essay).

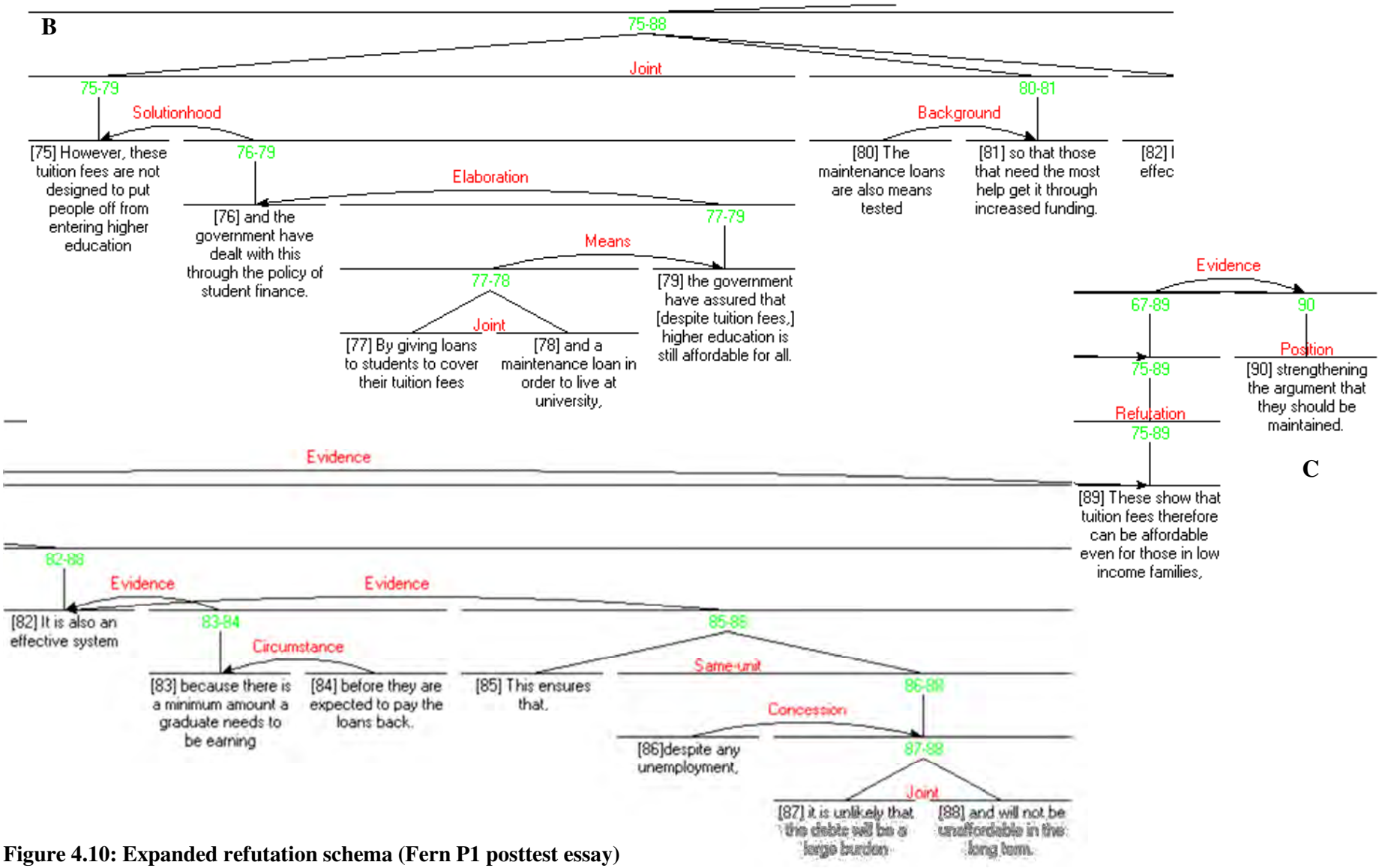


Figure 4.10: Expanded refutation schema (Fern P1 posttest essay)

Weighing-minimization schema

A writer applies a weighing-minimization strategy to show that the advantages or disadvantages of a course of action are limited or can be curtailed. The implication is that the writer holds a less strong belief in this action. A definition of the minimization relation is introduced, following the RST pattern.

relation name: MINIMIZATION
constraints on N: W has positive regard for the situation presented in N
constraints on S: W is claiming that the situation presented in S may also hold
constraints on the N + S *combination:* W acknowledges potential conflict but also compatibility between N and S
the effect: R's positive regard for the situation presented in N is decreased
locus of the effect: N +S

Figure 4.11 shows minimization applied as part of a paragraph. Figure 4.12 shows minimization applied as the strategy of the whole paragraph. The advantage, expressed in Figure 4.11 in support of the counter position, is minimized. Weighing-minimization differs from refutation in that the advantage or counterargument is not completely overpowered, shown to be false or irrelevant. The minimizing component is usually not developed or supported as much as a refuting component.

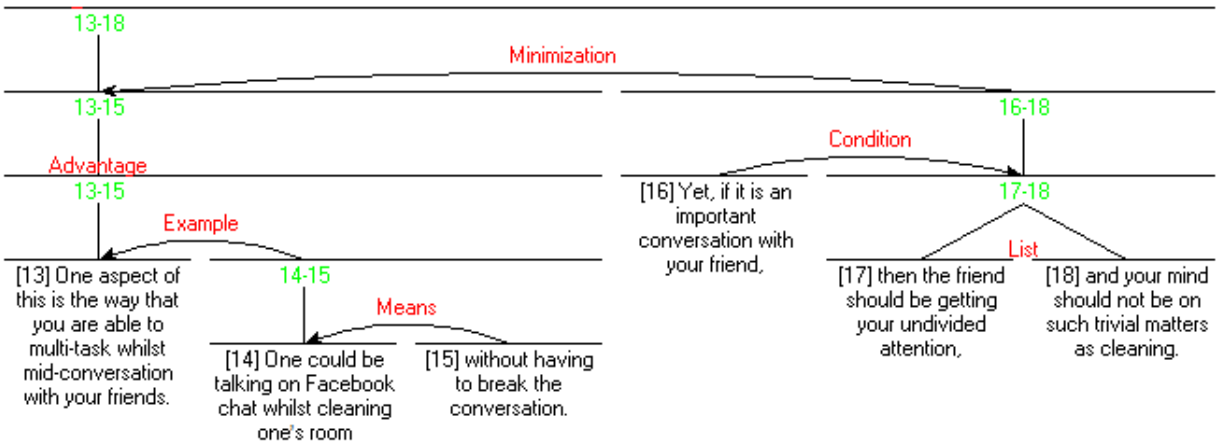


Figure 4.11: Example of weighing-minimization schema as part of a paragraph (Mary P7 Argument diagramming Essay)

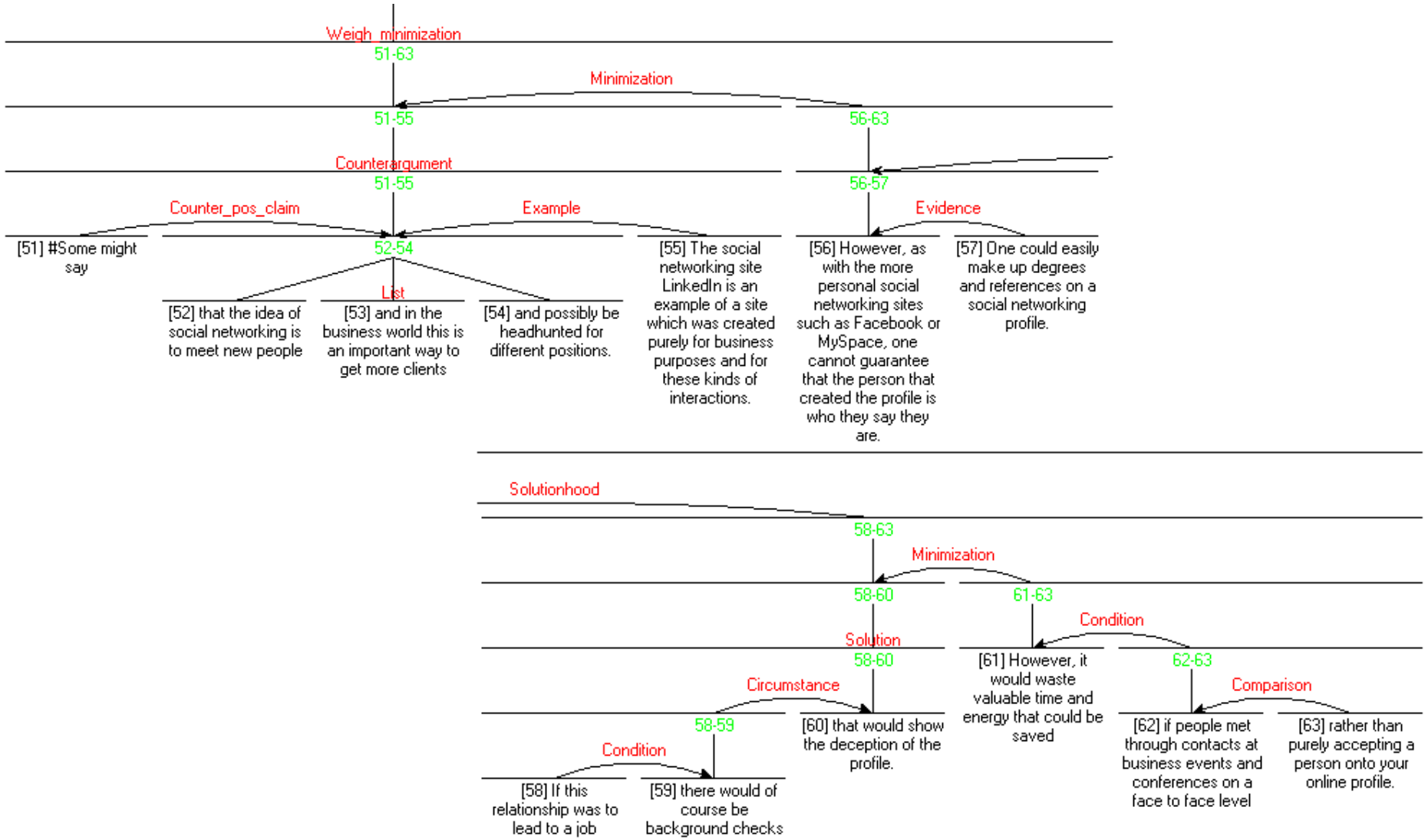


Figure 4.12: Example of weighing-minimization strategy applied at paragraph level (baseline essay of P1 Fern)

Weighing schema

In a weighing strategy, the writer considers advantages and disadvantages or both sides of an issue and deliberates and decides which side is stronger. The antithesis relation is important here as it points to the side to which the writer inclines mostly.

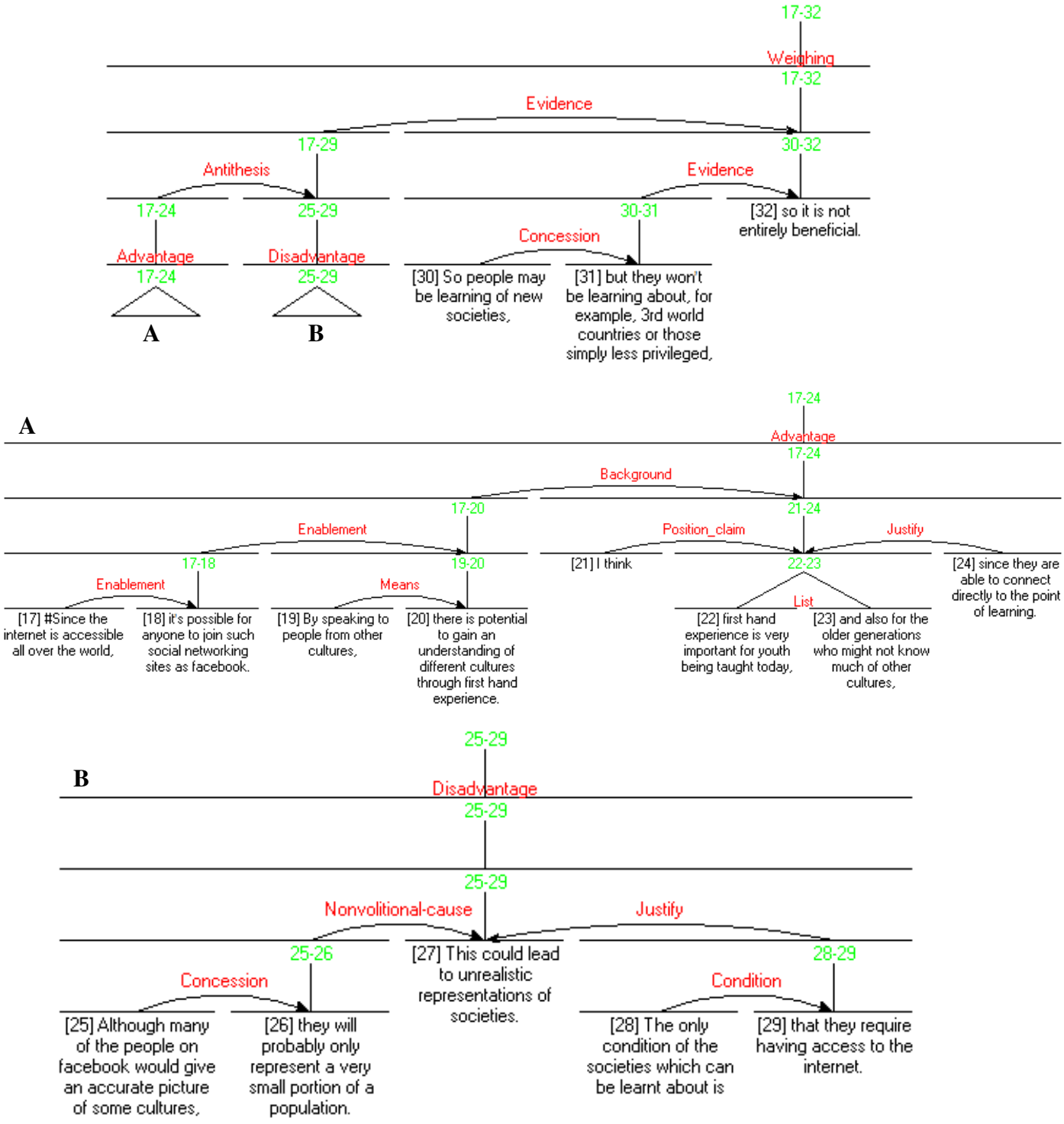


Figure 4.13: Weighing strategy applied at the paragraph level in the posttest essay of P13 (Pandora).

Figure 4.13 shows a paragraph where the weighing strategy is applied. At the first part of the figure, where the advantage and disadvantage trees are, we can see a schematic representation of weighing. The writer inclines towards favouring the disadvantage (EDU 25-29). This is reflected in the concluding sentence (EDU 32) showing that both sides may apply but the writer inclines to believing more in the disadvantage side.

'Juxtaposing advantages and disadvantages' schema

This is a schema that is considered less effective in terms of integrating arguments and counterarguments, than the refutation, the weighing-minimization and the weighing schema. The writer's intention may be to weigh up advantages and disadvantages or to weigh arguments against counterarguments but fails to do so in the text as her inclination about the stronger side or a synthesis of the two is not clear. In fact the reader is left to infer it - hoping that this inclination will emerge from further paragraphs or the concluding paragraph.

Figure 4.14 in the following page gives an example of juxtaposing advantages and disadvantages. Instead of an antithesis relation, that would indicate an inclination of the writer's regard, the *contrast* relation is used here, which is established between two nuclei. This assigns equal importance to both sides. According to Man and Thompson the effect of contrast relation is that the "R recognizes the comparability and the difference(s) yielded by the comparison being made". (1988, p. 278). In the 'Juxtaposing advantages and disadvantages' schema, the writer presents advantages next to disadvantages without expressing an inclination, which diverts from integration. The contrast relation joints the advantage (46-54) and disadvantage in (55-57). There is no indication within the whole paragraph (EDU 46-57) of the writer deliberating over the one or the other side. Unless a discussion would follow this paragraph or is included in the conclusion, this kind of strategy is more likely to perplex the reader.

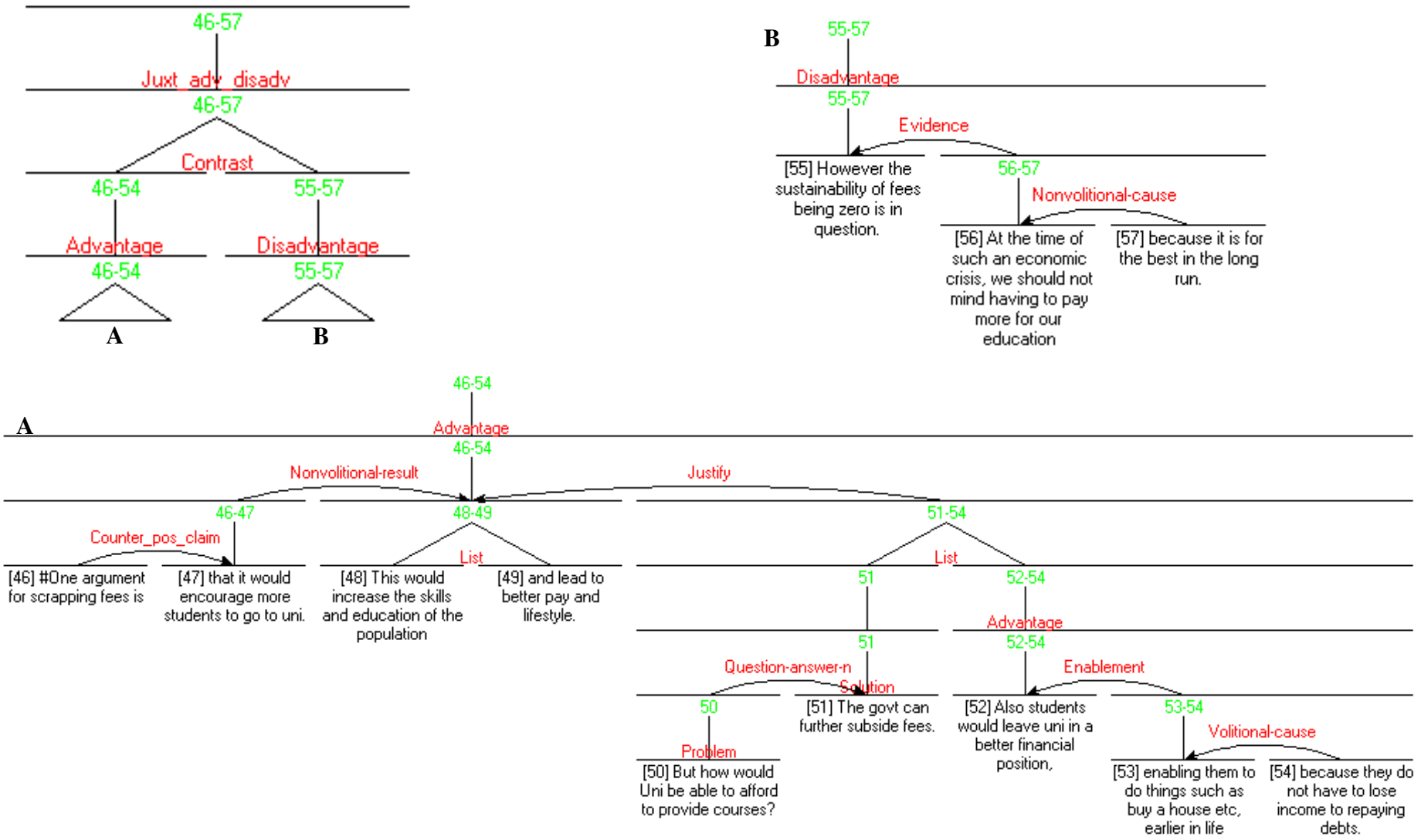


Figure 4.14: 'Juxtaposing advantages and disadvantages' strategy applied at the paragraph level in baseline essay of P16 (Antony).

Synthesis contingent schema

The synthesis strategy, allows the writer to integrate arguments of both sides in a compromise position. One way to express this compromise is to define under what conditions the writer would adopt one or another side. One way to think of contingency is to introduce an 'it depends' component. This specifies the conditions under which the arguments of the one or the other sided apply. To agree with the position it is necessary that a dependent condition, a contingent factor, also applies (Figure 4.15).

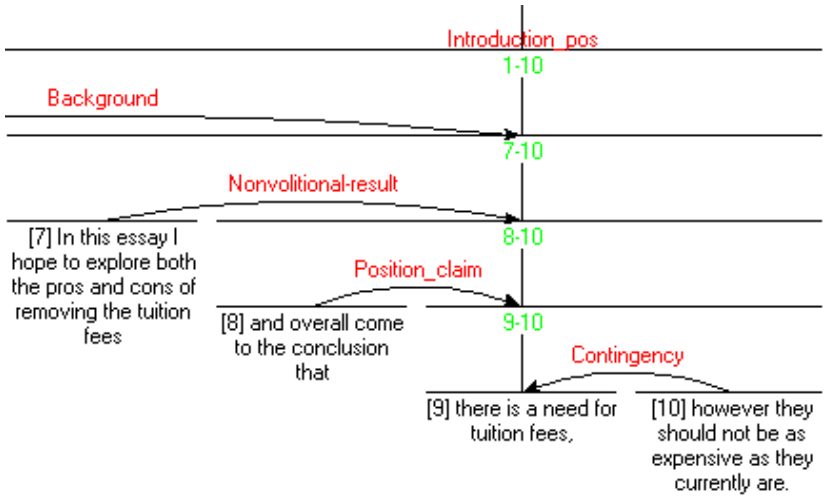


Figure 4.15: Synthesis- contingent strategy applied within paragraph level (baseline essay of P13 Pandora).

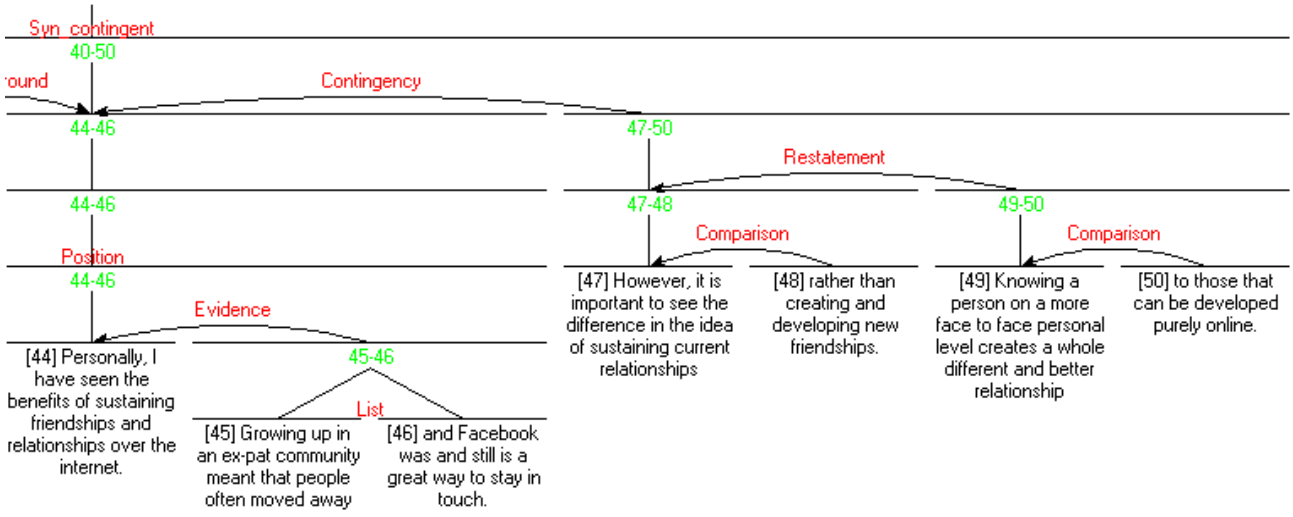


Figure 4.16: Synthesis- contingent strategy applied at paragraph level (baseline essay of P1 Fern).

relation name: CONTIGENCY
constraints on N: presents a statement countering or supporting the position, or the position itself
constraints on S: presents a situation
constraints on the N + S combination: N holds only if situation of S holds
the effect: R's recognizes the situation presented in S as absolute condition for N to hold
locus of the effect: N +S

In Figure 4.16 the whole paragraph is characterised by the Synthesis- contingent strategy. In this essay, the writer's position, as stated in her introduction, is that building friendships on social networking sites is not beneficial or even dangerous (See Figure 4.5). In this paragraph (Figure 4.16) she introduces that sustaining relations over social networking sites maybe beneficial as long as one can see the difference between creating and sustaining friendships.

Synthesis creative solution

Another way to introduce a synthesis strategy is to introduce a course of action that bypasses a problem, applicable when a practical, action-oriented issue is addressed. The RST solutionhood relation applies in this schema

relation name: SOLUTIONHOOD (Mann & Thompson, 1988, p. 273)
constraints on S: presents a problem
constraints on the N + S combination: the situation presented in N is a solution to the problem stated in S;
the effect: R recognizes the situation presented in N as a solution to the problem presented in S
locus of the effect: N and S

Here the problem is introduced (Figure 4.17, EDU 84-89), the danger of being bullied as implication of using social networking sites, but it is suggested that the problem can be managed thanks to measures that are in place. This cancels or reduces the impact of the problem which is thought to be manageable hereafter. Interestingly a similar structure is repeated in the following paragraph of the essay and included in the conclusion of the essay showing that this strategy prevails in the essay.

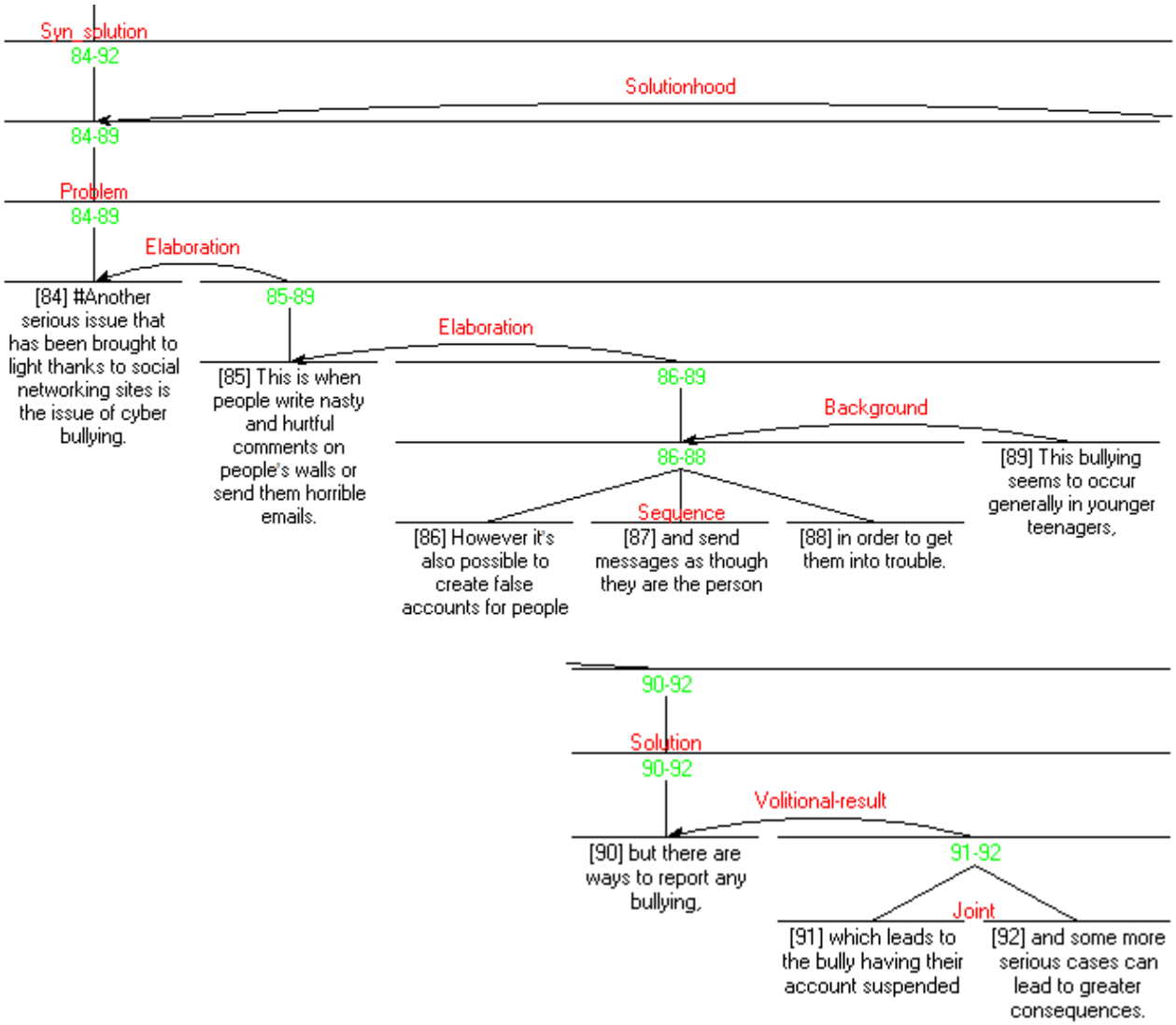


Figure 4.17: Synthesis- solution strategy applied at paragraph level in posttest essay of P13 (Pandora).

Overall, three new relations were introduced, minimization, contingency, counter position claim, and position claim, which is used to express position claims.

Table 4.5 gives an overview:

Argumentation schema	**RST relation**
Refutation	Antithesis, counter position claim (new)
Weighing minimization	Minimization (new)
Weighing	Antithesis
Juxtaposing advantages and disadvantages	Contrast
Synthesis - contingent	Contingency (new)
Synthesis - problem solution	Solutionhood

Table 4.5: RST relations that can help identify argumentation schemata

4.3.3 Incoherence issues

In a few cases during the analysis it has been impossible to establish a known RST relation (or any of those introduced in the previous sections) between one or more EDU units. When, due to lack of clarity, it is impossible to infer a rhetorical relation, one or more EDUs are defined as non-functional (NF) (Figure 4.18, EDUs 63-65).

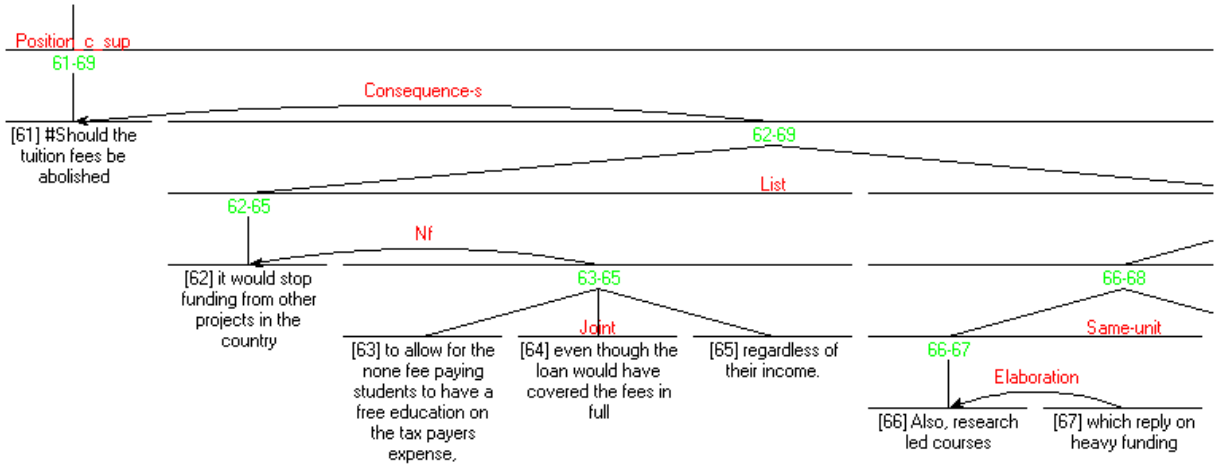


Figure 4.18: Non-functional EDU units are result of unclear relation (baseline essay P8 Charles)

Another problem of incoherence emerges in cases of topic drift or digression. This is another case where EDUs are defined as NF. The example bellow shows an example where the whole second paragraph does not contribute to the topic or the question set by the writer himself in the end of the introductory paragraph.

(…) Indeed, Facebook is probably the most important tool for creating and maintaining friendships and relationships nowadays amongst young people. However, should this be a reason for concern or something to celebrate?

These sites have evolved immensely over the last few years. As technology has improved and we've upgraded from slow dial-up connections to super fast broadband the capabilities of web pages have increased dramatically. Some websites, once massively popular, have fallen by the wayside as they failed to keep up with what people wanted but this can only be attributed to natural progression and evolution of ideas (P9 Harry baseline essay).

Finally, another problematic area is when the writer repeats content that is already stated in the same or closely situated paragraphs. Repetition may sometimes support coherence but not

always. A common use of repetition is when the writer refers to a supporting argument she or he has already presented in order to refute a counterargument (See Figure 4.6, p.133). Although repetitions are observed and recorded in the analysis they are not considered as NF.

Overall three types of incoherence are coded, *unclear, irrelevant* and *repetition*.

4.3.4 Argument structure schemata (level 2)

At this level of analysis it is postulated that while RST is valuable in identifying intra-sentence relations the macro-structure of the text is best showed with schemata.

Paragraph is important in this level of analysis, as an entity that sufficiently contains argumentation argument moves, e.g. position support, countering position, refutation of counterarguments. Relations between paragraphs also play a significant role in the semantic and rhetorical structure of essay.

An example of an 8-paragraph essay is given in Figure 4.19 and Table 4.6 through different representations (baseline essay of Fern P1):

In Figure 4.19 the hierarchical structure of the essay, including the introduction, the 6 paragraphs of the main body of the essay, and the conclusion can be overviewed on a collapsed RST tree overarching the whole essay. The expanded tree of essay is included in Appendix VII while instances from the same essay have been used as examples in previous examples of RST relations and argumentation schemata (evidence relation: Figure 4.5; justify relation: Figure 4.12: Synthesis-contingent: Figure 4.16). The writer includes her position in the introduction and an evidence relation can be annotated between each of the 6 paragraphs and the introduction. A concluding relation can be drawn between these 7 paragraphs and the conclusion. However the conclusion includes mainly the supporting arguments while a new counterargument, not developed in the essay is introduced (amplifying).

Table 4.6 shows how the RST analysis is quantified and recorded in one sheet in order to help the analyst conclude to the Argument orientation, including the orientation of EDU units, the paragraph schemata, and the problems. For each paragraph a comment related to the paragraph schema and strategies is given. This helps the analyst to record observations while reviewing the RST analysis tree and to decide the paragraph schema (a full list of paragraph schemata and definitions is given in the following pages in Table 4.8). A correspondence between Table 4.6 and Figure 4.19 (and Appendix VII) can be traced following the recorded EDU units. All EDU units are assigned an orientation measure, depending on their relation to the essay position: SUP (supporting the position), CNTR (countering the position), REFT (refuting CNTR EDUs, NEUT (Neutral, e.g. background information regarding the topic), and NF (non-functional see 4.3.3 Incoherence issues p.146). These measures are added and calculated in percentage per total number of EDUs at the bottom of the table (using on an excel file form). This recording is completed for every essay, first, blind to the writer's identity, and then the identity is revealed so that a comparison between baseline and posttest essay is possible.

The instrument (excel sheet) in Table 4.6 was used for recording purposes. The information of 32 sheets is presented briefly in the tables of chapter 5. For example the information in the excel sheet, shown in Table 4.6, is summarised in the upper part Table 5.24 (p. 258). The sums in the bottom left of the excel sheet, i.e. the total sum of argument moves and the total sum of EDUs of a given orientation, are seen in the upper Argument Orientation section of Table 5.24. The paragraph schemata seen for each paragraph in the excel sheet, e.g. 1. Introduction, 2. Position_c_sup, 3. Position_c_sup and so on, are presented in the upper middle part of Table 5.24. The problems seen highlighted in red on the excel sheet are presented in the upper right part of Table 5.24.

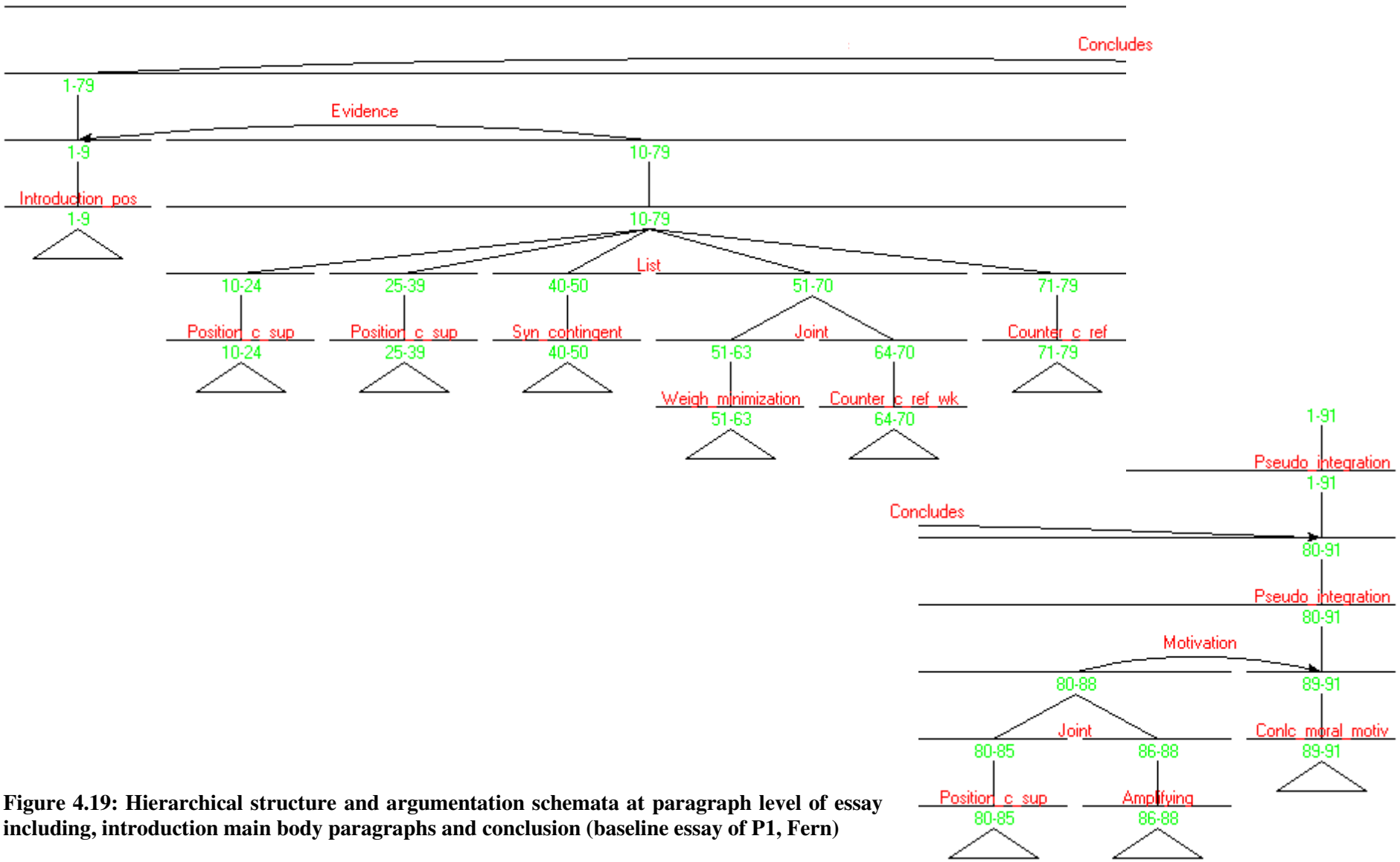
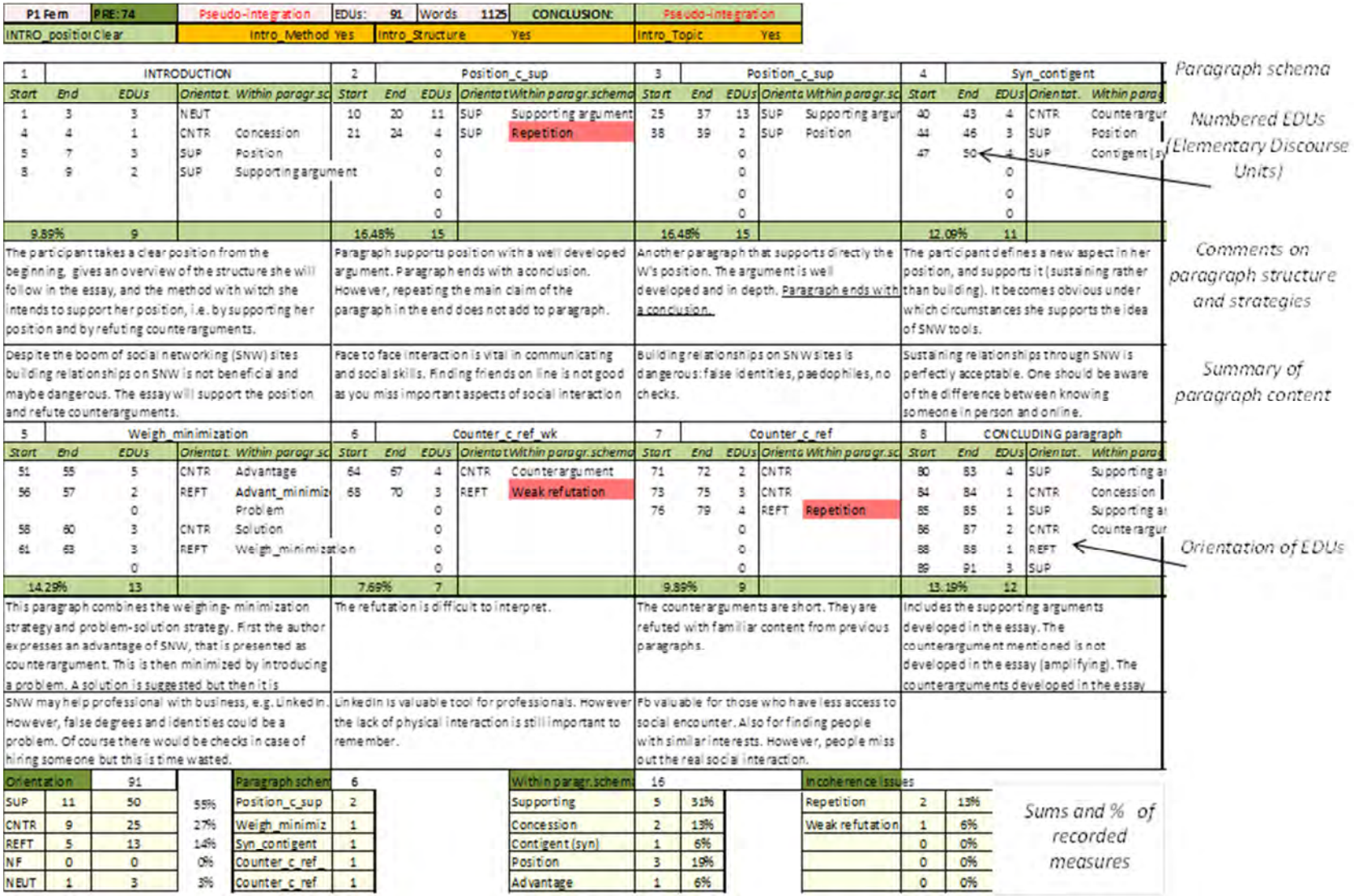


Figure 4.19: Hierarchical structure and argumentation schemata at paragraph level of essay including, introduction main body paragraphs and conclusion (baseline essay of P1, Fern)



P1 Fern	PRE: 74	Pseudo-integration	EDUs: 91	Words 1125	CONCLUSION:	Pseudo-integration
INTRO_positior Clear		Intro_Method Yes	Intro_Structure Yes		Intro_Topic	Yes

1	INTRODUCTION				2	Position_c_sup				3	Position_c_sup				4	Syn_contigent			
Start	End	EDUs	Orientat.	Within paragr.sc	Start	End	EDUs	Orientat	Within paragr.schema	Start	End	EDUs	Orienta	Within paragr.sc	Start	End	EDUs	Orientat.	Within para
1	3	3	NEUT		10	20	11	SUP	Supporting argument	25	37	13	SUP	Supporting argur	40	43	4	CNTR	Counterargur
4	4	1	CNTR	Concession	21	24	4	SUP	Repetition	38	39	2	SUP	Position	44	46	3	SUP	Position
5	7	3	SUP	Position			0					0			47	50	4	SUP	Contigent (sy
8	9	2	SUP	Supporting argument			0					0					0		
							0					0					0		
							0					0					0		
9.89%		9			16.48%		15			16.48%		15			12.09%		11		
The participant takes a clear position from the beginning, gives an overview of the structure she will follow in the essay, and the method with witch she intends to support her position, i.e. by supporting her position and by refuting counterarguments.					Paragraph supports position with a well developed argument. Paragraph ends with a conclusion. However, repeating the main claim of the paragraph in the end does not add to paragraph.					Another paragraph that supports directly the W's position. The argument is well developed and in depth. Paragraph ends with a conclusion.					The participant defines a new aspect in her position, and supports it (sustaining rather than building). It becomes obvious under which circumstances she supports the idea of SNW tools.				
Despite the boom of social networking (SNW) sites building relationships on SNW is not beneficial and maybe dangerous. The essay will support the position and refute counterarguments.					Face to face interaction is vital in communicating and social skills. Finding friends on line is not good as you miss important aspects of social interaction					Building relationships on SNW sites is dangerous: false identities, paedophiles, no checks.					Sustaining relationships through SNW is perfectly acceptable. One should be aware of the difference between knowing someone in person and online.			

5	Weigh_minimization				6	Counter_c_ref_wk				7	Counter_c_ref				8	CONCLUDING paragraph			
Start	End	EDUs	Orientat.	Within paragr.sc	Start	End	EDUs	Orientat	Within paragr.schema	Start	End	EDUs	Orienta	Within paragr.sc	Start	End	EDUs	Orientat.	Within para
51	55	5	CNTR	Advantage	64	67	4	CNTR	Counterargument	71	72	2	CNTR		80	83	4	SUP	Supporting ar
56	57	2	REFT	Advant_minimiz	68	70	3	REFT	Weak refutation	73	75	3	CNTR		84	84	1	CNTR	Concession
		0		Problem			0			76	79	4	REFT	Repetition	85	85	1	SUP	Supporting ar
58	60	3	CNTR	Solution			0					0			86	87	2	CNTR	Counterargur
61	63	3	REFT	Weigh_minimization			0					0			88	88	1	REFT	
		0					0					0			89	91	3	SUP	
14.29%		13			7.69%		7			9.89%		9			13.19%		12		
This paragraph combines the weighing- minimization strategy and problem-solution strategy. First the author expresses an advantage of SNW, that is presented as counterargument. This is then minimized by introducing a problem. A solution is suggested but then it is					The refutation is difficult to interpret.					The counterarguments are short. They are refuted with familiar content from previous paragraphs.					Includes the supporting arguments developed in the essay. The counterargument mentioned is not developed in the essay (amplifying). The counterarguments developed in the essay			
SNW may help professional with business, e.g. LinkedIn. However, false degrees and identities could be a problem. Of course there would be checks in case of hiring someone but this is time wasted.					LinkedIn is valuable tool for professionals. However the lack of physical interaction is still important to remember.					Fb valuable for those who have less access to social encounter. Also for finding people with similar interests. However, people miss out the real social interaction.									

Orientation	91		Paragraph schem	6	Within paragr.schemi	16		Incoherence issues		
SUP	11	50	55%	Position_c_sup	2	Supporting	5	31%	Repetition	2	13%
CNTR	9	25	27%	Weigh_minimiz	1	Concession	2	13%	Weak refutation	1	6%
REFT	5	13	14%	Syn_contigent	1	Contigent (syn)	1	6%		0	0%
NF	0	0	0%	Counter_c_ref_	1	Position	3	19%		0	0%
NEUT	1	3	3%	Counter_c_ref	1	Advantage	1	6%		0	0%

Table 4.6: Recording of EDU's per paragraph and argumentation schemata at paragraph level and within paragraph level (example from Fern)

After recording the details on the excel sheet the analysis concludes with identifying 3 noteworthy aspects for each essay. These help to categorise essays at levels of argumentative ability and compared with those of the posttest essay. An example is given in section 4.3.6.

In the introductory and the concluding paragraphs, it is important to identify the nature of the position. In the example of Table 4.6 the position is clearly presented. Five alternative schemata are identified for the introduction and the concluding paragraphs (Table 4.7):

Argumentation schemata of the introduction at paragraph level		
Schema	Definition	Schema Code
Introduction without position	The participant does not present a position in the introduction	NEUTRAL
Introduction with hinted position	The reader may infer a preference of the writer's but the writer does not clearly express his or her position	HINTED POSITION
Introduction with position	Introduction including the position of the author	POSITION
Position with qualification	The position is moderated with a qualification, that is a reservation or a restricted or a partial application of the position	POSITION-QUALIFIC.
Position Contingent	It specifies the conditions under which the position is true. The writer defines under what conditions the position is true or different positions that are true under different sets of condition	POSITION-CONTING.

Table 4.7: Schemata characterising the introductory and the concluding paragraphs

Except the introductory and the concluding paragraphs the remaining paragraphs are assigned to a schema that denotes the orientation of the paragraph with respect to the position and the adopted strategy. A list of schemata at paragraph level is given below (Table 4.8):

Schema	Definition	Code
Position is supported	The main position or claim of the essay, is supported.	Support
Position is weakly supported	This applies to less effective application of the previous 'support' schema. The supporting argument may be unclear, a mere repetition of previous content, or not very relevant.	Support weak
Counter position is supported	A claim that is not supportive of the main position is developed and supported in the paragraph.	Counter-argument
Counter position is not refuted	This applies when the counter position is not elaborated further or integrated elsewhere in the essay. In plain terms the counter argument to the essay's position is not refuted.	Counter unrefuted
Refutation	The counterargument is refuted. The counterargument is opposed by another claim or argument which argues that the counter-argument is wrong, insufficiently supported or irrelevant (See also p.133).	Refutation
Supported refutation	The counterargument is refuted by an argument that is developed in depth	Refutation-deep
Weak refutation	An attempt to refute counterclaim can be identified but the content is somewhat weak, or difficult to understand, or irrational.	Refutation-weak
Weighing minimizatio n	The strength of an advantage (or disadvantage) is minimized by a disadvantage or (advantage) (see also p.138).	Weigh min.
Weighing	Advantages and disadvantages are compared and weighed out (see also p. 140)	Weighing
Juxtaposing advantages and dis-advantages	Advantages and disadvantages are juxtaposed in the paragraph without weighing out one or another or without being compared to one another. In other words, there is no evidence of weighing out or comparing in order to show preference over advantages or disadvantages (see also p. 141).	Juxt adv-disadv
Synthesis: creative solution	A claim supporting the writer's position is expressed by resolving an issue, offering, in Nussbaum's terms (Nussbaum, 2008) , a creative solution. The solution tries to minimize the negative impact of the problem.	Problem-solution
Synthesis Contingent	It specifies the conditions under which the supporting or countering arguments apply. The strategy allows the writer to integrate arguments of both sides in a compromise position. The compromise is realised by adopting both side positions and defining under what conditions the writer would adopt each of them and, perhaps, in what preference (p.143).	Synth. contingent
Irrelevant paragraph	It is impossible or difficult to establish a relation between the paragraph and any other paragraph or section of the essay.	Irrelevant

Table 4.8: Schemata characterising the argumentation of paragraphs

Central in the conceptual approach taken in this chapter is the notion of argument and counterargument integration. Drawing on a review of argumentation schemata presented in the literature review chapter, 4 types of integration are named. The first two, the *myside bias* and the *pseudo-integration* do not integrate supporting arguments with counter arguments in the formulation of a position. The third, the *integration schema*, embeds arguments and counterarguments by employing weighing and refutation strategies. The fourth schema, the *synthesis*, is also an advanced integration schema that consolidates different views in a compromise position, employing weighing, refutation and other rhetorical strategies.

In *pseudo-integration*, the writer includes counterarguments in the development of the essay, and may present the supporting and opposing side of an issue, but formulates a position based on what he or she 'feels' strongly about (Nussbaum et al., 2007). The writer usually concludes without addressing already raised counterarguments. These are either ignored or silenced. Conversely the writer emphasises the importance of some supporting arguments by restating them in the conclusion or amplifying them with further examples or explanations of consequence (Nussbaum, 2008).

Schema	Definition	Schema Code
Synthesis	An advanced integration schema that consolidates different views in a compromise position, employing weighing, refutation and other argumentation strategies.	SYN
Integration	Embeds arguments and counterarguments by employing weighing and refutation strategies.	I
Pseudo-integration	The writer includes counterarguments in the development of the essay but formulates a position based on what she 'feels' strongly about, or concludes without addressing already raised counterarguments, or emphasises the importance of some supporting arguments by restating them in the conclusion or by introducing new arguments amplifying them with further examples or explanations.	PI
Myside bias	The writer excludes or ignores information that does not support their own position	MSB

Table 4.9: Schemata characterising the concluding paragraph

4.3.5 Adversary and conciliatory strategies

These are both argument and counterargument integration strategies but with a characteristic difference. Refutation strategies (both weak refutation and deep refutation) are adversary strategies, aiming to invalidate counterarguments by showing that they are false, irrelevant, or insufficiently supported. Conciliatory strategies express compromise, middle ground, synthesis of opinions and moderated positions. Weighing, weighing-minimization, synthesis-contingent, and synthesis creative-solution are conciliatory strategies. Conciliatory strategies appeared in Pseudo-integration groups, however in this group they are used consistently in the expression of the position as well as in other argument moves

4.3.6 Identification of crucial changes in text (level 3)

After completing the analysis of level 1 and 2 the coded names are removed and the baseline is compared against the posttest essay. For each essay a maximum of 3 main aspects of improvement or deterioration are inferred. The following table (Table 4.10) gives an example for participant P1, Fern.

Refutation integration improves, increases and prevails as argumentation strategy
In the baseline essay, the participant is able to develop a good structure and to handle a range of strategies. She employs weighing-minimization, synthesis-contingent and refutation strategies. **In the posttest essay,** refutation increases by 21% and prevails as argumentation strategy, while counterarguments reduce slightly (-8%). Refutation is developed in depth, analysed more clearly, with supporting statements. In one case of refutation, the refuting statement and supporting reasons take up a whole separate paragraph.
Flow, depth and thematic connectivity improve
In the baseline essay, the main weakness is with inventing and developing refutations. Here, one refutation is weakly developed and difficult to understand. In the second case, where she employs the refutation strategy, she re-uses content from previous paragraph (repetition). **In the posttest essay**, flow and thematic connectivity between paragraphs improves. Arguments and paragraphs are developed more in depth. Average length of paragraph increases. Repetitions and unrelated arguments are eliminated

Table 4.10: Example of two crucial text changes as result of text analysis (example from Fern)

4.4 Methodology of analysing the planning and linearizing process in writing argumentative essays

The data sources for the investigation of cognitive process and strategies are video recordings of participants' think aloud talk, synchronized with video of the actual process on paper and/or on computer, and planning products, that is, paper or computer-based plans of the essays. The analysis of process involves:

i) the *transcription* of these data sources,

ii) *dimensions* of planning products (for baseline and posttest essay) and *use of argument diagramming notation* (posttest essay)

iii) the segmentation of each writing session in *process episodes* (planning, linearizing, interleaving, using criteria list, etc.),

iv) a *summary of the process* based on a descriptive account of the episodes, and *overall comparison* of planning and linearizing process for baseline and posttest essay of each participant

v) and the *focused interpretation of critical text changes* (identified by the essay analysis) through process episodes.

4.4.1 Video transcription

The 32 writing sessions of the 16 participants were transcribed to allow a systematic overview of planning, linearizing and revising activities through a single script. The activities were observed on the merged streams of video (see Figure 4.4D, p.124) and planning products (e.g. notes diagrams etc.). Transcribing activities that take place on more than one media, e.g. paper, computer screen, human voice, is a challenging methodological issue explored in recent education and learning research (see for example research on mutlimodality Jewitt, 2009)

In order to consolidate activities and information in one transcript, a protocol is introduced for annotating the different data sources. Table 4.11 gives the key to annotations in the transcript; Table 4.12 gives an example of transcription and refers to the diagram of Figure 4.20. The think aloud talk of the participants is transcribed verbatim. The plans, notes, and composed text are annotated with references (see numbers highlighted in yellow in Figure 4.20) which are integrated in the transcript.

Figure 19 depicts a diagram plan produced with the software programme *Rationale 2*™ as part of the essay planning process of participant Harriet (argument diagramming phase). The indexes in yellow show the order with which the statements were entered in the diagram by the participant. The textboxes 1, and 16-21 make the right branch of the tree. The transcription from Table 10 shows that this branch was created by following a train of thought without interruption from textbox 16 to textbox 21, including supporting countering and refuting moves. This shows that in this part of the diagram the content was developed *in depth*, expanding over 3 cascading levels, without interrupting to attend another part of the diagram. At the other end of the spectrum, an *opportunistic* development of the diagram is noted when the participant adds textboxes as they come to mind, shifting from one part of the diagram to another. The differentiation between in depth and opportunistic development is taken into account during analysis.

/narration/	It describes observable activities on screen
'think aloud talk':	Whatever the participant talks aloud during the planning and writing session
[1] <planning> : includes index for order of entry	Ordered entry of planning notes or textboxes, on paper or on computer.
<<typing>>	Notes and text typed on computer
<<wording from diagram>> (Computer group only)	Content copied from computer-based diagram and pasted on word editor
****ticks off criteria list ****	The participants ticks an item of the criteria list, e.g. ticks off clear position item

Table 4.11: Key to video transcription annotations

‘Ok, let’s see if I can get some reasons ‘for’.’
/She thinks out loud, referring to [1], ‘Staying in touch with people.’/
/New textbox (Supports), connected down from [1]/
[16] <Starting at university I have moved away from very close friends who I miss greatly and use Facebook to stay in touch with>
/She reads aloud [16] as she types it/

‘Similarly….’
/New textbox (Supports), linked next to [16]/
[17] <Similarly, I can talk to family and it is a quick and easy way of sharing photos en masse, which you cannot really do in emails>
/She reads aloud [17] as she types it/

‘You could object to that by saying….’
/New textbox (Opposes), connected down from [17]/
[18] <Having family as friends, especially as a student, is perhaps slightly inappropriate with the nature of some of the information you are sharing>
/She reads aloud [17] as she types it/

‘I can continue that and say perhaps….’
/New textbox (Opposes), linked next to [18]/
[19] <Though there is a way to flag up inappropriate images, your friends can tag you in the pictures which may not always be tasteful and you may not have chance to un-tag yourself or remove the image before someone else sees it>
/She reads aloud [19] as she types it/

‘I’ll continue with that.’
/New textbox (Supports), connected down from [18]/
‘I can support having family as friends, especially as a students, is perhaps slightly inappropriate with the nature of some of the information you are sharing [18] with….’
/She deletes the new textbox (Supports), connected down from [18]/
/She briefly adds but then deletes a new textbox (Supports/ connected down from [19]/
‘I don’t know whether to keep that. Right, I’m going to add a ‘Reason’ to both of them to say….’

/New textbox (Supports), connected down from [19]/
[20] <In my personal experience, having my brother in law as a friend was problematic after one big night out>
/She reads aloud [20] as she types it/

‘I’m going to object the box though, all together…’
/New textbox (Rebuts), connected down from [19]/
‘…and say that actually…’
[21] <Again, it is very much up to the user what information they wish to disclose and you are not obliged to give family members access to your profile>
/She reads aloud [21] and reviews the left side of the computer-diagram/
‘So I think we’ll go back to the question.’

Table 4.12: Extract of video transcription of participant Harriet during the planning process

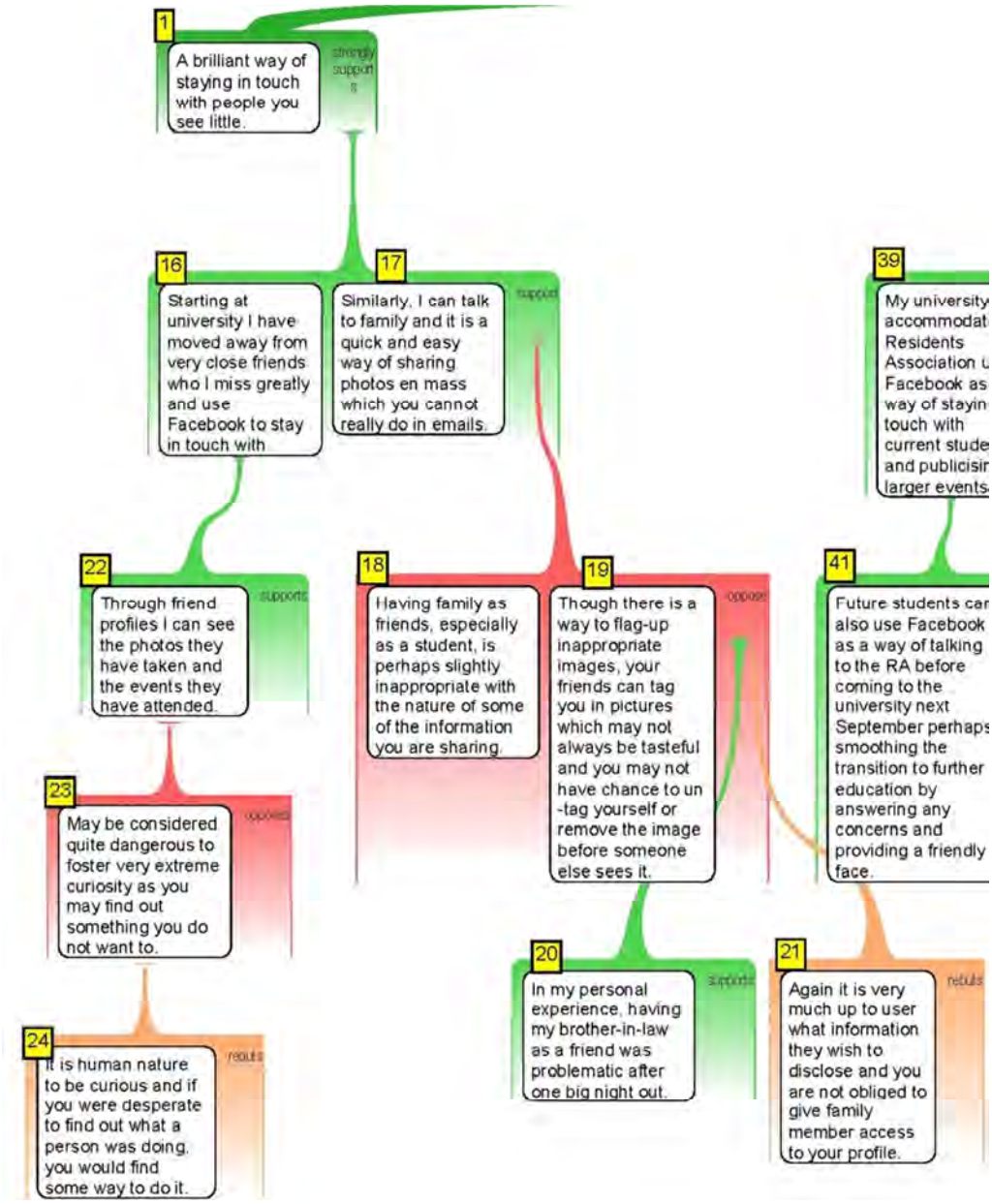
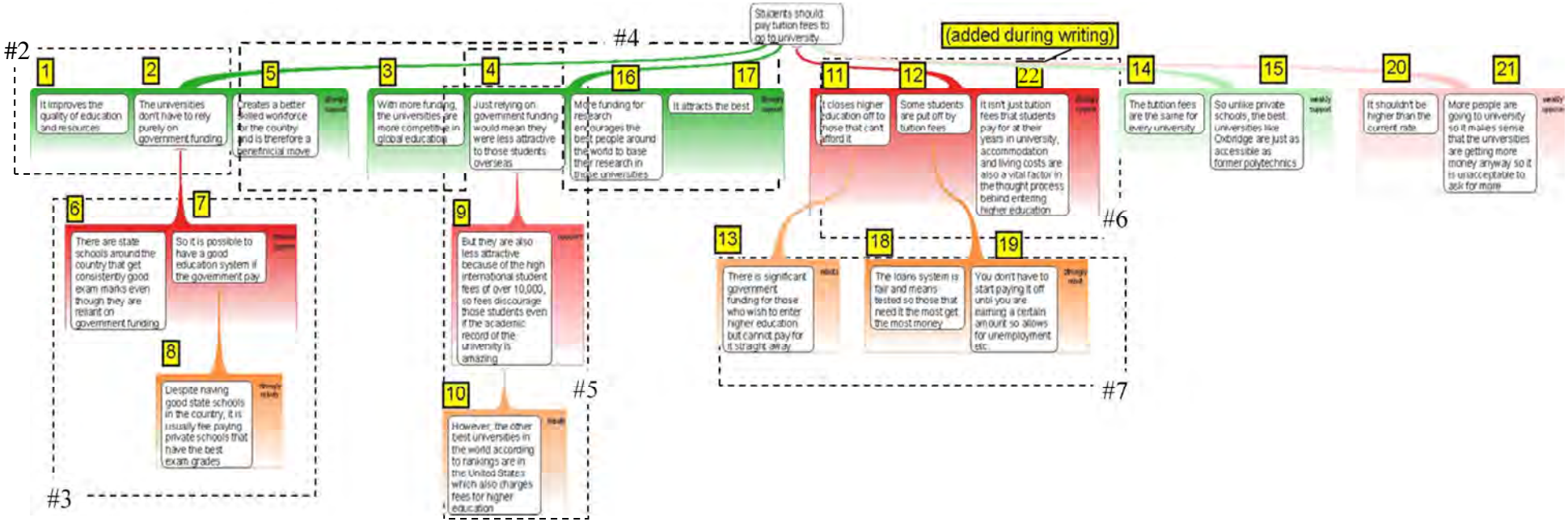


Figure 4.20: Part of diagram produced with the software Rationale 2.0 by participant Harriet

In order to understand the process of linearization of the diagram the transcription and analysis took into account how a diagram was translated into text. Figure 4.21 depicts the whole diagram that participant P1 (Fern) constructed before composing her posttest essay. The figure also illustrates with annotations how the essay was organized in paragraphs: the dotted frames set the boundaries of paragraph content and are annotated with the # symbol and a number that refers to the paragraph. A part of the diagram is excluded from the essay (boxes 14, 15, 20 and 21), following an evaluation of the diagram content. If we follow the transcription extract of Table 4.13 we see that the participant rephrases and expands on the content of the diagram and then, having integrated most of the diagram content, she reflects on the relevance of the remaining content, and decides to exclude it.

/Pauses briefly to review what she has just written/ <<…in order to live at university, the government have assured that despite tuition fees, higher education is still affordable for all [13].>> /Pauses briefly to review what she has just written/ <<The maintenance loans are also means tested so that those that need the most help get it through increased funding [18]. It is also an effective system because there is a minimum amount a graduate needs to be earning before they are expected to pay the loans back [19]. This ensures that despite any unemployment [19] or varying circumstances, it is unlikely that the debts will be a large burden and will not be unaffordable in the long term.>> /Pauses briefly to review what she has just written/ /She deletes 'varying circumstances' from the latest sentence/ <<This shows that tuition fees therefore can be affordable even for those that don't have very much money…>> /She changes the current sentence to <<[those]in low income families>>/ /Stops typing/ /She scrolls to the top of the essay, runs a word count/ /Items [20] and [21] are visible/ 'So I've written all the points now and I think I've rebutted it fair and quite well. But I just think the last two points don't need to go in the essay. I think they're more sort of assertions rather than arguments. 'Tuition fees are the same for every university' [14], it doesn't really argue why tuition fees are a good thing, and 'It shouldn't be higher than the current rate' [20] is a completely different argument. So I mentioned that in my introduction but I don't think it should go in the actual essay. So I'll just quickly write a conclusion and then go over it

Table 4.13: Extract of video transcription of participant Fern during the linearization phase of posttest essay



KEY:
The dotted frames show how the participant organized the content of the diagram in paragraphs.
The number with the #symbol on the frame indicates the number of the diagram, as identified in the essay analysis (see for example).

Figure 4.21: Overview of an essay diagram, created with the software Rationale 2.0 by P1 Fern, and linearization in paragraphs.

4.4.2 Dimensions of planning products

The analysis of planning process draws on understanding how the participants use the diagramming method, whether on paper or on computer. It also draws on the planning method and strategies the participants use before being introduced to the diagramming method.

Type of baseline plan

The plans produced during the planning of the baseline essay are coded under one of the following *types*:

- A random list of points: random notes produced during a short brainstorm phase
- A network diagram: a simple diagram that supports a brainstorm phase, exploring issues around a central concept, establishing semantic links between notes, but without argument orientation structure. In this type of plan there are no central claims or defined position nor a list of positive and negatives points associated with a central concept.
- An argument content plan: it is structured around supporting, opposing arguments and sometimes refuting opposing arguments. A central position is expressed or hinted. Lists of advantages and disadvantages are common in this type of plan
- A rhetorical plan: it may evolve from the content or the other types of plan by adding numbers or arrows indicating the order with which content will be presented in the text. It may as well be a new plan in the form of an outline, often with numbers indicating the order of arguments, and organizing the topic in themes. It may reuse or rephrase the content of another plan produced earlier. In this case we have two rounds of planning, content and rhetorical.

Measures of baseline plan

The *time* spent on producing one or more types of plan is recorded as a measurement of planning. The *amount of entries*, for example the number of items in a pro or against list, is counted. It is also noted whether or what *linearization strategy* the participant adopts for integrating the plan content in the essay, such as reflecting on the produced plan and numbering the entries in order to define the order of presentation, or just using the plan as reminder of content for the next paragraph. It is also observed and recorded whether the participant *formulated her or his position during the planning phase*, entered the planning phase with a formulated position, or continued to deliberate on her or his position during writing and until concluding the essay.

Type of plan	Planning duration	Plan entries	Position formulation	Use of criteria list	Linearization strategy	Interleaving
Network diagram	12 minutes of total 1h 27 minutes	26	Position not formulated during planning. Deliberation continues until conclusion.	Criteria list not consider often but guide the planning and writing process.	The plan does not help the writer to set composing goals. These are set before each paragraph. It serves as reminder of ideas.	The writer adds entries to plan twice while composing

Table 4.14: Process measures (example from Ann)

An example of a baseline plan (Figure 4.22) and recorded measures (Table 4.14) are given. The participant (Ann) plans using a network diagram (Figure 4.22) exploring issues around a central concept (‘pay tuition fees’) for 12 minutes. Initially, the plan does not have an argument orientation structure, e.g. a list of positive or negatives points. Later on, the

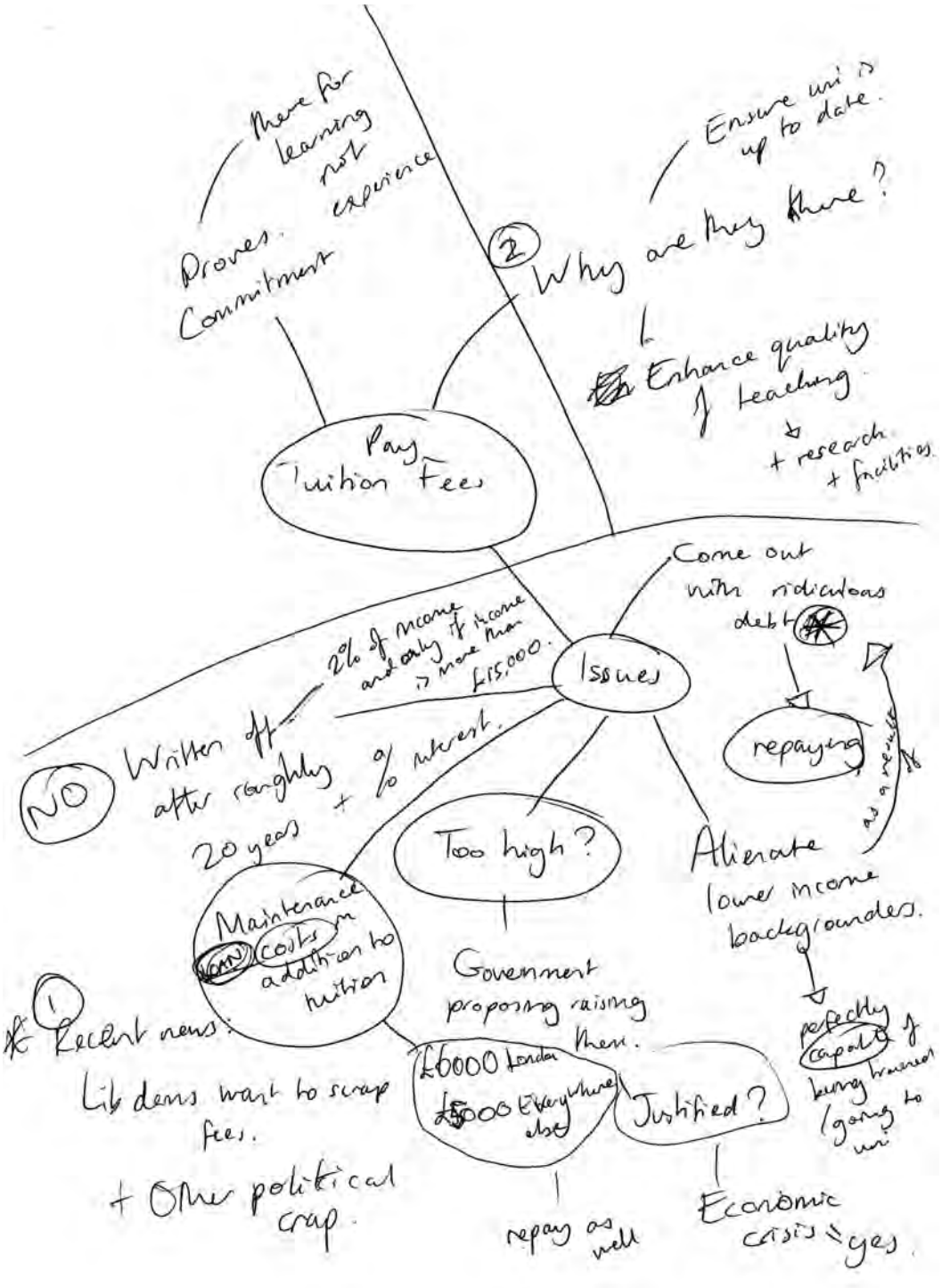


Figure 4.22: A network diagram produced by P6 (Ann) during the planning of the baseline essay

participant draws some lines trying to establish a few causal associations, and to anticipate opposing views. Although the diagram covers most of the ideas she later includes in the essay,

it did not help her to define clear goals with regards the structure of paragraphs (linearization). After finishing a paragraph the participant reflects on the content, acknowledges to herself the purpose of the paragraph, and writes a concluding statement. She then turns to the diagram to explore what other topics she has not included in the essay. During writing the participant spends long pauses on rethinking about words and revising content.

Summaries, similar to the one presented in the previous paragraph, encompassing important aspects of the planning and linearizing process, are compiled for each of the 16 participant's and are compared with the essay process summary of the argument diagramming phase.

Measures of posttest essay

Measures recorded for the baseline essay such as time spent on planning, number of textboxes, and linearization strategy, are also noted for the posttest essay.

Additionally, *the width and depth of the diagram* is also measured, by counting the number of nodes of the longest diagram tree (depth) and the number of trees (width).

Crucially, the diagrams are reviewed for correctly applying the notation, e.g. using rebut link when a counterargument is refuted. Issues in using the proposed notation, as afforded by the *Rationale 2*^{TM} software or the equivalent paper-based method, are taken into account. The *semantic connectivity* between textboxes is also reviewed, that is whether a sensible connection between textboxes is established.

Interleaving

A linear progression from planning to writing is usually observed, however, in a few cases, the participants interrupted the composing process and return to planning to add notes and links.

Use of criteria list

The participants were given a 6 point list referring to aspects of argument structure formulation, and were asked to tick next to each item whenever they consider it, during planning or writing (see Table 4.4, p. 123). Ticking off the items of the list acquired an interesting role for the study. Rather than logging their argumentation activity, in many cases the participants were returning to the list to use it as guidelines, hence the list had a *guiding* role. For other participants it maintained the role it was intended to have, to show when the items of the list were taken into account, allowing the analyst to log the activities proceeding or following this; hence the list played a *confirming* role. This aspect was recorded for both the baseline and posttest essay.

4.4.3 Segmentation of transcripts in process episodes

Each one of the 32 transcripts was segmented in process episodes based on the writer's observed activity. A process episode is defined by the beginning and end of a thought in the think aloud script or an activity that relates to a writing process. In line with other protocol studies of the writing process (Beauvais, Olive, & Passerault, 2011; Smagorinsky, 1991; van Weijen, van den Bergh, Rijlaarsdam, & Sanders, 2009), the process episodes were coded using a coding schema that is based on Hayes and Flower's model of writing process. The

main codes are presented below in lower case font and the codes in upper case denote a group of codes.

CONTENT GENERATION

Position formulation		Argumentation moves		
Expressing position	Reflection on position	Supporting	Opposing	Refuting

STRUCTURE

PLAN TYPE-STRATEGY	LINEARISATION			
	CONTENT SELECTION	PRIORITIZATION	CONTENT INTEGRATION	
Random list Network diag. Content plan Rhetorical plan	Content inclusion/exclusion	Prioritization of planned items	Relying on plan closely	Expanding on plan

GOAL SETTING

Criteria List: confirming		Criteria List: guiding	METACOMMENTS	
Aware of argumentation moves	Hesitant about argumentation moves	Item motivates relevant action	Self-criticism	Self-appraisal

Table 4.15: Overview of video transcript coding scheme

4.4.4 Summary of the process episodes and overall comparison

For each of the 16 participants' case the baseline and argument diagramming phases are summarised. Then the coded episodes are consolidated in a summary list (Table 4.16) .

Baseline	Argument diagramming
1. Declaring planning strategy, investigate own position after reflection. 2. Content invention (pc-based list) (7') and reflection leading to position 3. Content plan includes refutation 3. Rhetorical plan, include intro and conclusion 4. Linearization: - prioritizes and expands existing content plan - selection of relevant ideas 5. Criteria list: does not guide planning process (confirming it guides revision). while ticking: - anticipates ideas would develop more while writing/unsure about refutation 6. Writing follows closely but also expands rhet. plan (interleaving) 7. Criticises repetition and unrelated items (as identified during RST analysis) 8. Revision takes place in two rounds but problematic aspects are not rectified. 9. Criteria list guide the revision process. Uncertainty about refutation remains.	1. Straight to diagram with a clear position in mind - would like notation to allow contingency synthesis strategy 2. Planning with *Rationale 2*™ diagram following a strategy of argument moves (32') - not opportunistic planning. - good use of co-premise notation, playing the role of warrant - reflection on balance of argumentation making sure to expand counter and supporting side equally 3. Prioritization of arguments using the evaluation function 4. Linearization, decides on order and grouping of arguments in paragraphs by reflecting on diagram 5. Plan to text transition. Use of automatic outline. Rearranges diagram and re-produces automatic outline. 6 Writing follows closely the automatic outline. Points of textboxes are expanded significantly, including refutations. 7. Flow of text is gained by following connections of diagram, developing themes in depth, integrating counterarguments and refutation in separate paragraphs. Paragraphs ends with a conclusion. 8. Limited revision but in two quick rounds.

Table 4.16: Summary of baseline and argument diagramming phases of participant Fern

4.4.5 Focused interpretation of text change through process episodes

This final phase in the process analysis establishes a link between the text analysis and the process analysis. Going back to the final step of the essay analysis, the example there (section 4.3.6, p.154) presented two crucial changes in the text, i.e. improvement in refutation and thematic connectivity. The final step in the process analysis is to interpret these changes through the identified changes in the process. Thus, as presented in Table 4.17, the improvement in refutation is explained by more extensive planning and careful linearization of the diagram. The improvement in thematic continuity is attributed to three improved processes. i) Lengthier engagement in planning, ii) Expanding on diagram content during composing, and iii) Evaluation and selection of diagram content in order to be included in the essay.

Refutation integration improves, increases and prevails as argumentation strategy
In the baseline essay, and while ticking the relevant list item at the end of planning, she appears, unsure about refutation itself, hesitating to add further to the plan. After revision she also remains unsure regarding refutation. **In the posttest essay,** refutation that is planned on the diagram is integrated effectively in the essay. The participant has carefully organised each paragraph on around 2 textboxes on average, corresponding in some cases a whole argument to one argument move (e.g. one paragraph covers only refutation). Rather than integrating the whole argument branch in one paragraph the participant segments each branch into argument move (see Figure 4.21). Regarding the possibility of employing a wider range of strategies, for example synthesis, the participant expresses some criticisms. She remarks that the notation should support, as early as the definition of position, a synthesis-contingency approach.
More extensive planning

Careful linearization of diagram
Flow, depth and thematic connectivity improve.
In the baseline essay, it is worth noted that she is aware of the all the 3 problematic issues that were identified during the RST analysis. She identifies the same repetitions and she is unhappy with the unrelated refutations. Although she promises to come back to rectify these issues there is no improvement after revision. **In the posttest essay,** the participant engages with the plan creatively and extensively. The diagram textboxes are carefully edited and integrated in the diagram taking extra care of the in-between associations (improved connectivity). In particular the participant reads carefully the existing textbox before attaching a new one rephrases and expands content in the textbox before moving on, carefully choses wording in textboxes. Also the premise and co-premise function is used effectively (warrants) (e.g. see boxes, 1,2, 6,7). Also some of the diagram content is excluded from the text, following an evaluation of the diagram content by assigning strength on textboxes. **This process of content selection may be the reason behind the elimination of unrelated content**. The diagram content is expanded in the essay making the most of planned content without needing to reuse the same idea. Although the automatic outline function is used the content is not simply pasted in the essay. **In the baseline essay**, points are presented with reference to orientation, starting with paragraphs that refer to support and moving on to counter argumentation and refutation, following the predefined order of points. It is indicative that she uses, 'first, second, third'. Every paragraph treats a new them. So we could talk about enumeration of points around position orientation. **In the posttest essay,** the rhetorical presentation of paragraphs changes. In the second essay the writer forms paragraphs with reference to themes, one theme every two paragraphs, taking also into account the orientation. We could perhaps talk here about further deepening on each theme.
Lengthier engagement in planning **Expanding on diagram content** **Evaluation and selection of content to be included**

Table 4.17: Example of focused interpretation of critical text changes

4.5 Limitations of methodology

A limitation of this study is the fact that the participants wrote only one essay after becoming familiar with the diagramming method. A follow up would probably reveal if the changes observed persist over a longer period of time. To compensate for this, the design covered a wide range of cases, 16 in total

Regarding the analysis of data the involvement of more than one rater would have enhanced the reliability of the results and would have control against subjective bias. However, resources were not available to train and employ more raters. A measure was taken to reduce bias. The analyst was blind to the participants' identity in the analysis of essays and whether the essay was the baseline or the argument diagramming

Finally, another limitation is related to the heterogeneity of the participants in terms of the university school they attend. However, a balanced mixture of arts and science students participated in the study.

Chapter 5 Study 2: Findings and discussion

Studies 1a and 1b found that the initial ability of argumentative writing played an important role on how argument diagramming impacts argumentative writing. The approach of Study 2 focuses on taking into consideration the level of argumentative writing ability and relates it to the argumentative writing processes and the use of argument diagramming. Study 2 is also exploring argument diagramming as a paper-based and computer-based method, making a comparison of the two whenever this is possible.

Thus chapter 5 addresses the following research question

RQ2. How does argument diagramming as a method of supporting the planning of argumentative essays affect the cognition of the writing process and the quality of argumentative text?

In order to explore this research question, Study 2 was set up with sixteen (n=16) first-year undergraduate students who were native speakers. Each student participated in a 7 hour long study. A pre-post design was adopted in order to compare writers' baseline planning and writing practices with those adopted when using an argument diagramming method. The comparison was done on the basis of online observed practices during planning and composing and the produced essays and diagrams. The essays were written using a similar diagramming method, as in studies 1a and 1b, on paper or on computer. The participants in the computer group used the *Rationale 2* ™ (http://rationale.austhink.com/) and those in the paper group used an equivalent method on paper. The participants were given 2 hours for planning and writing an argumentative essay of 1300 words during the baseline session. After completing the baseline essay, they received a 2 hours training in using argument

diagramming either computer-based or paper-based. They then were given another 2 hours to plan and compose the posttest essay.

This chapter discusses critical argumentative text changes in relation to changes in argumentative writing process. First, the identified text changes, namely improvement or deterioration of the argumentative essays in terms of argumentation schemata and coherence of argumentative essays, are identified. Then, process changes, that is, changes in planning, translating and revising process, are identified with reference to how they contribute to the identified text changes. The findings are based on the consolidation of the analysis of essays and on the analysis of process data. The analysis of the baseline essays categorised the participants in 5 groups based on their argumentation schema. i) My side bias (MSB), ii) Pseudo integration – Low, iii) Pseudo integration – middle iv) Pseudo integration - high v) Integration and Synthesis. The presentation of the analysis follows this categorisation.

5.1 Coherence of argumentative essays

Studies investigating the impact of instructional intervention on quality of text have found that coherence is the highest predictive determinant of text quality (Bamberg, 1984; Chase, 2011; Connor & Lauer, 1985; De La Paz, 2005). Linguists refer to cohesion, which is sometimes considered as a quality that is dependent on coherence (e.g. Bamberg, 1984). Coherence refers to the overall plan or schema that organizes the writer's ideas whereas cohesion refers to elements of language and surface structure. The following aspects were found to be highly correlated with coherence: organization of text, lack of digression, inclusion of concluding statement, and smooth flow of discourse due to grammatically constructed discourse and use of lexical cohesive ties (Bamberg, 1984; Connor & Lauer, 1985; De La Paz, 2005). Organization of text is understood as a quality of coherent text defined when the writer

appears to have a clear plan, according to which she organizes details, and which she sustains it throughout the essay (Bamberg, 1984).

Rhetorical Structure Theory (RST) (Mann et al., 1992; Mann & Thompson, 1988) is a discourse analysis theory and methodology that represents text coherence "by postulating a hierarchical, connected structure of texts, in which every part of a text has a role, a function to play, with respect to other parts in the text" (Taboada & Mann, 2006b, p.425). In study 2 the analysis of essays was carried out following the 3- level analysis employing the Rhetorical Structure Analysis (RST) (Section 4.3 in Chapter 4, pp.126-154, gives a detailed description).

The results from the analysis of the baseline and posttest essays and the changes between baseline and posttest essay were consolidated and found to pertain to two aspects: the *semantic structure* and *rhetorical structure* of the essay.

5.2 Semantic structure of argumentation

As presented in "Chapter 2 Theoretical review and previous research" (Section 2.2.5 p.36), *semantic argumentation structure* refers to how ideas of an argumentative communication are related to each other and to the main position or claim of the essay. The levels of semantic structure are defined on the basis of argumentation schemata identified in Chapter 2 (pp.32-35). The four argumentation schemata, myside bias, pseudo-integration, integration and synthesis, provide a framework for evaluating the level of 'integration of argument and counterargument' (Nussbaum & Edwards, 2011; Nussbaum & Schraw, 2007). Following this framework, and after consolidation of the findings of the essay analysis, the baseline essays of the 16 participants are assigned to progressive levels. The same levels are used to assign the posttest essays, and thus establish whether there is improvement or deterioration. Assigning the essay to each level is defined by five parameters of semantic argumentation structure:

1. Essay position. How the position is expressed in the introduction and the conclusion of the essay, that is, whether the position expresses one side of the debate only or whether it integrates aspects of the other sides of the debate, whether it is clearly expressed or hinted, and whether, if stated in the conclusion, draws on the developed points.

2. The **range of integration strategies** used. Argument and counterargument integration strategies, such as refutation, weighing and synthesis-contingent, are defined on the basis of qualitative descriptions, presented in chapter 5. The methodology chapter is referring extensively to argumentation strategies and paragraph argumentation schemata. Two types of strategies are distinguished: first, adversarial strategies, that is countering and refutation strategy, weighing minimization and second, conciliatory strategies, problem-solution, weighing and synthesis-contingent.

3. Argumentation balance: An EDU (Elementary Discourse Unit) is the unit of analysis in Rhetorical Structure Analysis (RST) while an argumentation move is a block of EDUs of the same orientation. The argumentation balance refers to the balance of EDUs and argumentation moves with different orientations i.e. position supporting (SUP), position countering (CNTR), and refuting counterarguments (REFT). It is of interest, for example, whether supporting argumentation moves outnumber the number of countering moves.

4. Argument-position coherence: This refers to the agreement and consistency between the main position of the essay and the arguments contained in it**.** A contradiction between the main position and the developed argumentation can occur, for example, when a writer, who takes a clear position, introduces a counterargument to this position, but she does not integrate it in the discussion of the concluding part of the essay.

5. Integration strategy: This refers to weakness in applying a strategy which integrates arguments and counterarguments. For example, a Pseudo-integration essay can identify both arguments and counter-arguments which do not interact with each other in a process of a dialogue. Another form of weak integration can emerge through weak refutation.

Based on these parameters, six levels of semantic structure were identified in the analysis:

1) My Side Bias (MSB)
2) Pseudo integration Low
3) Pseudo integration Middle
4) Pseudo integration High
5) Integration and Synthesis

5.3 Rhetorical structure of argumentation

The rhetorical structure of argumentation refers to making the semantic structure communicable through text. Rhetorical structure encompasses many aspects such as the hierarchical and linear structure of text; the necessary linguistic encoding and markers that are needed to convey this structure; the order of presenting the semantic structure elements to the reader (linearization); the qualities that make a text flow, with a clear, plausible and logical structure. Assigning the baseline and posttest essays to different levels of rhetorical argumentation structure is defined by five parameters:

A. Rhetorical structure organisation: Themes or argument orientation play an important role in the linearization of argument semantic relations**.** Thematic connectivity is achieved by organising discussions around themes or subthemes. For example, dispersing the same theme across non-consecutive paragraphs in the essay interrupts the thematic connectivity.

B. Juxtaposition, found often at paragraph level, where a paragraph countering the position appears after a paragraph supporting the position, or, within the same paragraph, advantages and disadvantages are juxtaposed without being weighed out or compared.

C. Development of depth, referring to the deep or shallow development of statements and paragraphs, resulting accordingly in stronger or weaker arguments. The phenomenon of chains is relevant here; for example when writers switch abruptly between supporting, countering and refuting moves and introduce short countering and refuting statements they use small chains and end up to development of low depth**.** Relevant is also the phenomenon, where less skilled writers dismiss a counterargument hastily and then move on to supporting arguments.

D. Relevance, such as when the writer digresses from the topic and introduces content that is difficult to relate with the rest of the text or the main position of the essay. Conversely an essay with high relevance contains text that is related thoroughly to the main position.

E. Clarity, essays demonstrate low clarity when they include unclear statements, namely text that is impossible to interpret in the context of the topic and paragraphs. Language or semantics may be the cause of low clarity issues.

F. Repetition of arguments is another parameter, whereby the same argument developed more than once in the essay denotes high repetition. A common phenomenon is when a writer first introduces supporting arguments and then she reuses it to refute a counterargument.

On the basis of the presence or not of these parameters, each essay was placed as of low or high quality in terms of rhetorical structure. For instance low rhetorical quality denotes low thematic continuity, enhanced juxtaposition, low depth and a lot of irrelevant, unclear or repetitive statements.

5.4 Presentation of results

The presentation of results in the following sections includes a table for each participant that presents the results of text analysis for the baseline and the posttest essay (see for example Table 5.1. for the text analysis procedure see Section 4.3). The first two columns of each table present the total sum of EDUs (Elementary Discourse Units) of a given orientation and the percentage of EDU units of a given orientation per total number of EDUs. The third and the fourth columns present the argument moves of different orientation such as support, counter or refuting orientation, non-functional or neutral (an argument move is a block of EDUs of the same orientation. The right part of the table presents findings that refer to paragraph level. Paragraph schemata are defined in Chapter 4 (Table 4.8, p.152). Each paragraph, except the introduction and the concluding paragraph, is characterised with an argumentation schema (e.g. support, support weak, counterargument, refutation).

Furthermore the progress demonstrated in participants' texts is summed up in one table for each of the identified groups. For instance Table 5.3 presents the 'aggregate' results for Harry and Charlie who were identified by the research as forming the myside bias group.

The progress of participants is illustrated here in terms of semantic structure (parameters 1-4) and rhetorical structure (parameters A-F). Green cells denote improvement while red cells denote deterioration. The (√) symbol denotes presence of a parameter (1-5 or A-F) while (x) denotes absence of this parameter.

5.5 Myside bias (MSB) group

5.5.1 Myside Bias group: baseline text

Charlie and Harry are considered to be at the lowest end of the range of all the analysed essays. They are placed in the myside bias group because the baseline essay is characterised by the following patterns:

1. Essay position: The position is formulated on the basis of **one-sided argumentation**. The position is clearly presented, straight from the introduction, and when restated in the conclusion draws again on supporting argumentation, even if counterarguments are mentioned in the main body of the essay; no other strategy, such as the weighing, is used in formulating the position.

2. The range of **argumentation strategies** used is limited to mainly supporting the position and to a much lesser extent countering the position. For instance Charlie's 9-paragraph essay includes 6 paragraphs supporting the position of which 4 support it successfully, and 2 support it weakly (Table 5.1). Similarly, Harry's 11-paragaph essay includes 5 supporting paragraphs (Table 5.2).

3. Argumentation balance: Argumentation supporting the position outnumbers countering argumentation. This can be seen in the total percentage of EDU orientation as well as in the number of argumentation moves (for example Charlie' baseline essay has 58% SUP EDU, while 16 out of 25 argumentation moves are supporting moves, see Table 5.1). In comparison counter argumentation is introduced to a much lesser extent (for example Charlie' baseline essay has 25% CNTR EDU while out of the 25 argumentation moves, 5 are countering moves, see Table 5.1).

4. Argument-position coherence: The writer is trying to refute counterarguments; however, the refutation statements are problematic at times.

5. Integration strategy issues: Although refutation is attempted as strategy to integrate counterarguments, the presented refutations are weak. Refutation is weak when refuting statements are unclear or irrelevant. Weak refutation is using short statements to hastily dismiss counterarguments. Another problem is repetition. The writer repeats already developed supporting arguments to refute counterarguments.

Arguments Orientation						**Paragraph schemata**			**Problems**	
	EDU units		**Arg. moves**		**Para**	**Strategy**	**Composition**	**No**		**No**
	No	**%**	**No**	**%**	**No**					
Baseline										
SUP	76	58%	16	64%	6	Intro	POSITION	1		
CNTR	33	25%	5	20%	1	Support	SUP	4	Unclear	1
REFT	17	13%	2	8%	2	Support weak	SUP	2	Repetition Unclear	1 1
NEUT	0	0%	0	0%		Counterargument	CNTR	1		
NF	6	5%	2	8%		Refutation	CNTR-**REFT**	1	Repetition	1
Total	**132**		**25**		**9**	Refutation-weak	CNTR-**REFT**	1	Weak refute	1
						Concluding	POSITION	3	Weak refute Repetition	1 1
						Total		**13**		
Posttest										
SUP	64	51%	12	43%	3	Intro	POSITION	1		
CNTR	30	24%	7	25%		Support	SUP	3		
REFT	28	22%	8	29%	5	Refutation	CNTR-**REFT**	4	Repetition	1
NEUT	3	2%	1	4%		Refutation-weak	CNTR-**REFT**	1	Weak refute	1
NF	0	0%	0	0%		Concluding	POSITION	2		
Total	**125**		**28**		**8**	Total		**11**		

Table 5.1: Baseline and posttest essay of Charlie – (Myside, PC)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	49	40%	17	52%	5	Intro	POSITION	2		
CNTR	17	14%	6	18%		Support	SUP	5		
REFT	23	19%	6	18%	4	Refutation	CNTR-**REFT**	1		
NEUT	18	15%	1	3%		Refutation-deep	SUP-CNTR-**REFT**	1		
NF	15	12%	3	9%	2	Refutation-weak	CNTR-**REFT**	2	Weak refute Drift/digress	3 1
Total	**122**		**33**		**11**	Irrelevant		2	Drift/digress Unrelated	2 1
						Concluding	POSITION	1		
						Total		**14**		
Posttest										
SUP	24	32%	6	29%		Intro	POSITION	1		
CNTR	22	30%	7	33%	2	Counterargument	CNTR	1		
REFT	24	32%	6	29%	4	Counter unrefuted	SUP-**CNTR**	1		
NF	0	0%	0	0%		Refutation	SUP-CNTR-**REFT**	2		
NEUT	4	5%	2	10%		Refutation-deep	CNTR-**REFT**	1		
Total	**74**		**21**		6	Problem solution	CNTR-**REFT**	1	Weak solution	1
						Concluding	POSITION	1		
						Total		**8**		

Table 5.2: Baseline and posttest essay of Harry – (Myside, Paper)

Myside bias	Charlie (PC)		Harry (Paper)	
Semantic argumentation parameters in the baseline essay	BASL	ARG.D	BASL	ARG.D
1. Essay position: The position is formulated on the basis of **one-sided** argumentation.	√	√	√	√
2. Range of integration strategies: The strategies used are limited to mainly support the position and to a lesser extent countering and refuting the position	√	X[4]	√	√
3. Argumentation balance (EDU and argument moves orientation): Argumentation supporting the position outnumbers countering argumentation	√	√	√	X[5]
4. Argument-position coherence: Unrefuted counterarguments within paragraphs or as entire paragraphs.	√	√[6]	N/A	√[7]
5. Integration strategy issues: Weak integration as result of **weak refutations**, due to unclear, irrelevant, short-underdeveloped refuting statements and repetition.	√	**Less**	√	X[8]
Rhetorical argumentation parameters in the baseline essay	BASL	ARG.D	BASL	ARG.D
A. Rhetorical structure organisation issues: Thematic structure, argument orientation structure.	√	X	√	√
B. Juxtaposition: paragraphs or arguments juxtaposed without being weighed out	N/A	N/A	N/A	N/A
C. Development of depth: Shallow development of paragraphs or statements, short paragraphs, abrupt switching between argument moves and **chains.**	√[9]	√[10]	√	X[11]
D. Relevance: Digression/Topic drift, Unrelated statements	N/A	N/A	√	**Less**
E. Clarity: Unclear statements	√	X	N/A	N/A
F. Repetition: Related to refutation or supporting argument	√	**Less**	N/A	N/A
KEY: BASL: baseline essay, ARG.D.: posttest essay, √confirms existence of element, X element is absent, Less: element occurs less, Green shade indicates improvement, Red shade indicates deterioration				

Table 5.3: Myside bias group progress in argumentative text

[4] Refutation strategy is enhanced by increasing refutation moves.
[5] In terms of argumentation moves and EDU%, supporting and countering are balanced (Table 5.2).
[6] Weak refutations persist.
[7] Deterioration as two unrefuted counterarguments occurs.
[8] No weak refutations.
[9] Shallow development of paragraphs
[10] Complex structure – chain appears
[11] Chains reduced, better development in depth.

5.5.2 Myside Bias group: text change

Regarding the semantic structure, Charlie's weak refutation in the baseline essay is due to unclear, hastily developed re repetitive statements. Points which are presented as supporting arguments in the beginning of the essay are repeated in order to refute counterarguments, making the refutation not convincing. Additionally, other refuting statements are feeble or not developed in depth; for example:

> *As stated above, a person is unlikely to undertake a course if they are unlikely to gain a job from this afterwards. This may seem intuitive that if less people take the course then the funding for this may be reduced in proportion to the students studying it. This may eventually lead to the course being discontinued. This however, I believe, is not the case. The person is not liable to pay back the money until they find a job, most likely they will find a job in result of receiving the degree, in which pays over the income threshold and therefore would not need to worry about the costs involved with the course" (Paragraph #? Charlie, baseline essay).*

In the posttest essay, weak refutations, as result of repetition and unclear statements, are reduced. However, they are not eliminated completely. When Charlie attempts a more complex structure by integrating two refutations in the same paragraph, the result is an awkward chain and, thus, a weak refutation:

> *Effects of social networking (Title of paragraph)*
>
> *"Some may argue that spending ever more increasing time on social networking and internet communications can decrease persons face to face social interaction skills over time. A person may choose to stay in to talk to their friends over the internet and have no intension of meeting friends in which live chose in which they may physically socialize with. However, just because the relationship is over the internet it does not make it any less valid. And although a person may be spending more time on a computer than going to meet friends it does not necessarily mean that the person will be*

> *any less happy. On the contrary, a person may spend the extra money which they have saved from not going out and the time in which they have saved and may choose to put this to good use such as study or buying materials which can enhance their lives". (Paragraph #?,Charlie, posttest).*

In the posttest essay, refutation increases by 3 refutation paragraphs and 6 refutation moves (see Table 5.1). Overall, although it is possible to identify some improvements such as increased and better quality refutation, the other parameters of MSB semantic structure (Table 5.3 - 1, 3, 4) do not change. Charlie's posttest essay position is still one sided, with supporting arguments outnumbering countering arguments and weak refutations persisting.

Harry's weaknesses in his baseline are similar with Charlie's in terms of semantic argumentation structure (Table 5.3) but Harry's weak refutations are due to repetitive statements (more than Charlie). Harry improves more than Charlie in terms of refutation by eliminating completely the weak refutations. Although refuting EDU units do not increase, refuting moves are deployed better within the paragraph. This is related to doubling the depth of each refutation move: while in the baseline essay the average per refutation move is 2.5 EDU, in the posttest it increases to 4 EDU. Harry also improves in terms of another parameter, the argument balance: supporting, countering and refuting moves are more balanced in the text. There is also deterioration: two counterarguments, introduced in the posttest essay, are not refuted or not minimized or integrated in the position in any other way. An unrefuted counterargument undermines the strength of the position, unless it is acknowledged and integrated. Overall, Harry's essay improves in two aspects; weak refutation and argumentation balance, and deteriorates in one.

Charlie' posttest essay improves greatly in terms of rhetorical structure. Charlie's baseline essay suffers from many repetitions, unclear statements, and lack of thematic flow. This is despite the participant's effort to structure the text with argumentation structure headings

(supporting arguments, counter arguments, rebuttals) and theme subheadings (e.g. “implications of abolishing tuition fees”). Moreover, the text is segmented in short paragraphs, breaking down the continuity between supporting, countering and refuting argument moves. In the posttest essay, disruptions like repetitions and unclear statements are almost eliminated (Table 5.1 and Table 5.3, A-F). Furthermore, thematic continuity underlies the rhetorical structure organisation, making easier for the reader to follow the text: the essay is broken down in 4 themes, and, under each theme, supporting, arguments are presented in separate paragraphs, followed by paragraphs that included refuted counterarguments. Improvement of rhetorical structure organisation, elimination of unclear statements, and reduction of repetitions, qualifies for claiming a great improvement in relation to the quality of the rhetorical structure.

Harry improves in terms of rhetorical structure as well. In the baseline essay, there are problems, such as digressing from the topic, and interrupting the flow due to multiple short paragraphs. In Harry’s baseline essay, two out of 13 paragraphs drift away from the topic question (Table 5.2). In Harry’s posttest essay, digression is eliminated. Refutation moves are deployed better and chains are eliminated which pertains to improvement in development in depth. However, themes and argument moves are not kept together in one paragraph and the text does not flow better.

Finally, Charlie and Harry fail to integrate arguments and counterarguments in their conclusion in both essays. Charlie includes counterarguments in the conclusion of the posttest essay but, in order to refute them, he amplifies a point that is not developed in the essay. Harry’s conclusion summarises the supporting view with a remote hint to counterarguments.

In summary, in terms of semantic structure both Charlie and Harry improve refutation albeit with some problems. Charlie deploys a more complex refutation structure (chain). Harry on the other hand, succeeds in deploying refuting moves better; however he does not refute all counterarguments. Both participants improve in terms of rhetorical structure but in different aspects. Charlie progresses by improving the thematic structure and by including less unclear statements. Harry improves by developing refutations more in depth and eliminating digression. Formulating an integrative position remains challenging for both.

5.5.3 Myside Bias group: process change

As already mentioned, Charlie's baseline essay has weak refutations, as result of repetition and unclear statement. The process analysis shows that the participant plans for 11 minutes (of total 1 hour 32 minutes) and creates a content list of 9 points corresponding to for, against and rebuttals. He is guided closely by the criteria list (Section 4.2.8) while generating the plan list. The points in the plan are captured in short notes, not conveying fully what is expressed in the think aloud script. Two rebuttal points are introduced in the plan, one is unclear how it relates to the counterarguments, the other is a repetition of a 'for' point: these two problematic points of the plan correspond to the two weak refutation of the baseline essay.

In contrast his planning and translating strategies change during the posttest essay; Charlie plans for much longer (30 minutes out of total 1h 29 min) during which he produces a diagram of 23 textboxes, containing 5 refuting moves (see Table 5.6 for summary of process measures). This is an extended time on task and increased content in comparison to the baseline essay plan. As all diagram content is included in the essay, the increased diagram refutation moves can explain the increase in refutation moves in the text. When he translates the diagram in text, he does not simply copy and paste from it, but expands on it. He expands

and elaborates on a few weak semantic relations of the diagram turning them into good paragraphs. A remedial and successful approach to linearization that he applies is to reflect on how to organize a diagram sub tree in paragraphs (rhetorical structure organization) and if needed invent more arguments as he composes. An example is given in the following page to illustrate this. The sub tree (Figure 5.1), including the textboxes 8,14,13, evolves in two separate paragraphs, entitled as 'Health' (Table 5.4). A new refutation is introduced in the first paragraph (#8) (sentences highlighted in grey) in order to respond to counterarguments 8 and 14. Textbox 13, the refutation, is developed into a separate paragraph (#9), including a counterargument too

The extract below, from the think aloud script, illustrates how reflecting on the diagram makes Charlie to realise the existence of weak associations between diagram textboxes. It is worth noting that he becomes aware of 'vague' spots, after completing his diagram planning. This awareness is possible to contribute to eliminating unclear statements and reduce weak refutations.

> ****He ticks 1 Counter Argumentation****
> 'Counter arguments…'
> /He glances at the computer-diagram/
> '…have been listed.'
> 'Refutations…'
> ****He ticks 1 Refutations****
> '…they've been included.'
> /He hovers his pen above criteria 5. Clear argumentation)/
> /He looks at the computer-diagram/
> 'They need to be more clearly argumented, as they're quite vague. That'll be included in the report.'
> (Video extract from Charlie posttest essay)

Health

[#8]It has been said that as a result of people spending increasing amounts of time on the internet socializing, that people could become less healthy as a result of using these social networking sites opposed to going out to meet friends (8). This, to some people, may be seen as the fact that a person finds it easier and less effort to stay in than to go out and meet people (14). However, as can easily be explained, a person may be hindered by a disability, by a lack of money or by their social status or ability to make friends. These are all valid reasons for which a person may choose to befriend people via means of the internet rather than by searching for people in a street [added during linearization].

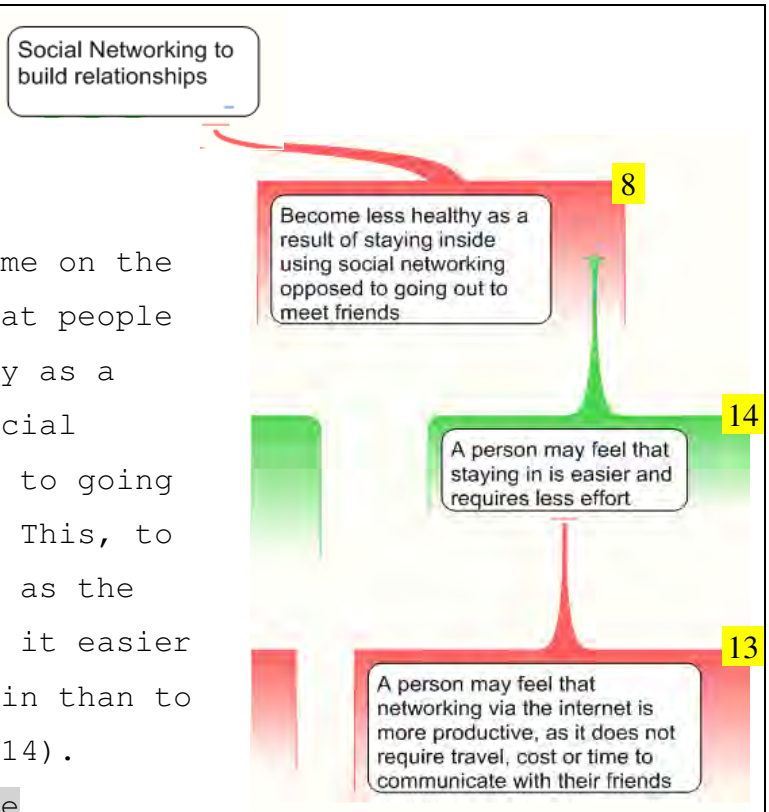


Figure 5.1: Sub tree of diagram (Charlie, posttest essay)

[#9]It is apparent that people benefit from physical social interaction with peers and that it may lead to a more happy life, however for a person to choose to spend some of this time to communicate with their friends via social networking on the internet is not a problem [added]. A person may feel that networking via the internet is more productive, as it does not require travel, cost or time to communicate with their friends, and as stated a person may use this money to enhance their lives (13).

Table 5.4: Charlie posttest essay, paragraphs #8 and #9

Furthermore, this example (Figure 5.1) also demonstrates a change in the linearization strategy that contributes to the improvement of the rhetorical structure. In the baseline essay, Charlie uses argumentation structure headings (e.g. supporting arguments) while in the second essay he uses theme headings that emerge from each sub tree. He was instructed during training how to reflect on the themes that emerge from the diagram and in this case this seems to have a good effect. Nevertheless linearizing and expanding on the diagram is not always as effective. When attempting to integrate a more complex structure in one paragraph, namely a sub tree of two refutation links and 5 textboxes, the result is a weak refutation (a chain of short and consecutive countering and refutation movers).This paragraph shows the effect of bad linearization (Table 5.5). The process analysis shows limited reflection on this part of the diagram, and no or very limited elaboration on the diagram text.

Effects of social networking Some may argue that spending ever more increasing time on social networking and internet communications can decrease persons face to face social interaction skills over time. A person may choose to stay in to talk to their friends over the internet and have no intension of meeting friends in which live chose in which they may physically socialize with. However, just because the relationship is over the internet it does not make it any less valid. And although a person may be spending more time on a computer than going to meet friends it does not necessarily mean that the person will be any less happy. On the contrary, a person may spend the extra money which they have saved from not going out and the time in which they have saved and may choose to put this to good use such as study or buying materials which can enhance their lives.

Table 5.5: Charlie posttest essay, paragraphs #7

In the baseline essay, Harry's planning process is very short (3 minutes of total 1h and 37 minutes) and poor in content, showing little effort in creating semantic associations between elements of the plan. He interacts very little with the plan while he composes. In fact he keeps the diagram covered under the criteria list sheet. Harry generates content as he reviews the text, triggered by words that stand out, almost in a 'knowledge-telling' manner, and he is prompted by the criteria list to invent counterarguments and refutations. Digressing from the topic occurs after using the word counting function and expressing a concern about needing to add content. Many times a paragraph is left unfinished before starting a new one on different aspect of the topic. He is often aware of weak refutations and criticises passages, that the text analysis defined as digression, but he does nothing to improve them.

Harry increased the planning time from 3 to 18 minutes, and tried to carefully apply the diagramming notation while producing a plan of 18 textboxes on paper. However, some issues regarding the application of the notation are observed. First, Harry introduced a question as the top level contention box rather than a tentative position (see Figure 5.2). Using a question maybe an advantage, especially if one is ambivalent, showing the intention of the participant to deliberate on his position. However, the application of colours and links requires committing during planning to a tentative position. Harry applies the colouring scheme as if he has taken the tentative position 'Students should not pay fees – Education should be free'. Second, and more crucial issue, is that upon completing the diagram, Harry reviews the balance of arguments, and concludes that there are more arguments supporting the opposing position, i.e. he thinks that the developed argumentation is supporting the position 'Students should pay fees'. Harry's process of diagramming on paper, including planning, translating and revising process is special. After completing the planning phase with the paper diagram Harry decides to drop his tentative position "Students should not pay fees".

His essay conclusion reads:

> *I believe that it is necessary for universities to charge tuition fees to help sustain the quality of higher education and research that we enjoy in this country. It is not a perfect system and some reform would improve it. However, on balance, I think students in higher education should be charged tuition fees. (Harry, posttest essay)*

Let us look closer at the diagram itself. Figure 5.2 shows Harry's paper-based diagram, showing how Harry used the space of an A4 paper (landscape) to fit his diagram. (Handwriting is transcribed to make it readable. Figure 5.3 shows how the same content would look if diagrammed with the *Rationale 2*™ software). The diagram consists of three sub trees, and following each sub tree from top to bottom it is possible to infer that the middle tree (textboxes 16, 15, 17, 18) does not support the tentative contention. As it is shown in the video transcription extract below, Harry reviews the diagram after completing it, however he fails to see that only the middle tree includes unrefuted counterarguments, while in the other two sub trees the counterarguments are refuted. The video transcription extract below starts when Harry introduced the last textbox of the diagram, i.e. textbox 18.

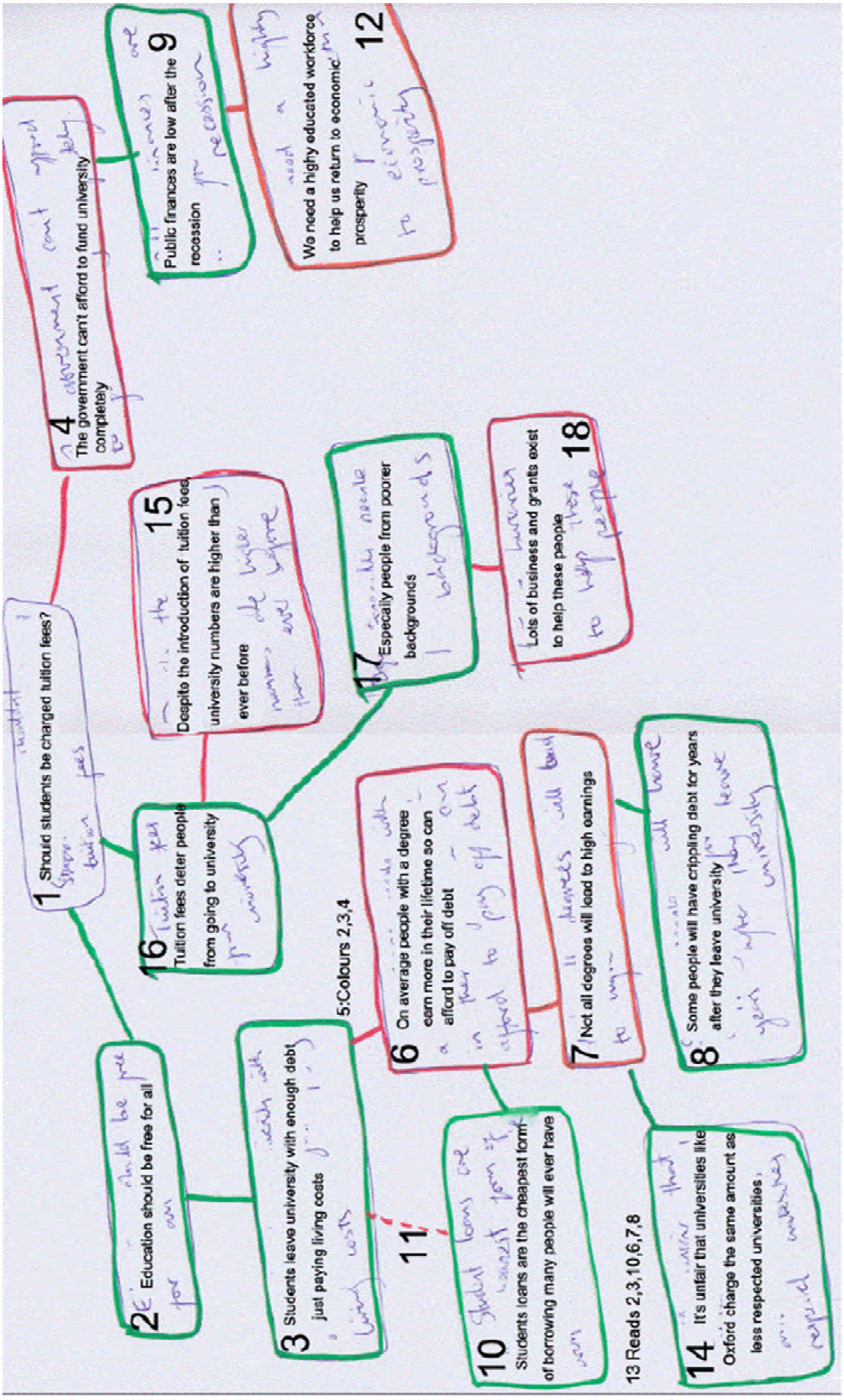


Figure 5.2: Posttest plan of Harry (Myside bias, paper)

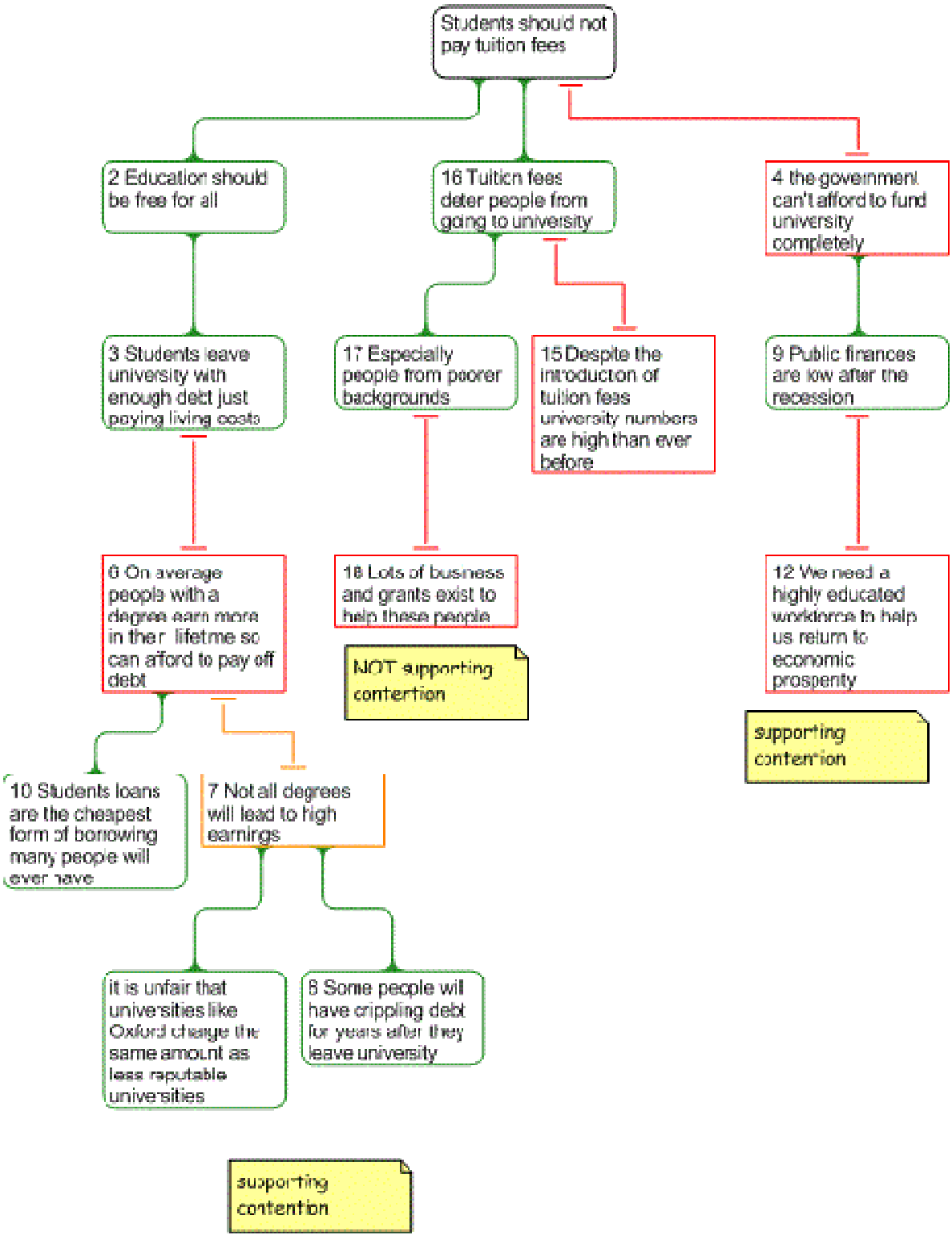


Figure 5.3: Paper-based posttest plan transcribed into computer-based plan (Harry / myside bias, paper)

[18] <Lots of bursaries and grants exist to help these people>
/He reads aloud [18] as he writes it/
'So that opposes that.'
/He draws a red box around [18]/
/He reads aloud [1], [16], [17], [18], [15],
/He turns his attention to the third tree/
[4], ('However…'), [9], ('However…') and [12]/
/He studies the left side of the diagram/
/He points the pen at [2], [3] and [10] respectively, probably reviewing these items/
/He reads aloud [6], [7] and [8]/
/He seems to review [14]/
'Ok, so far it looks like there are more arguments for paying tuition fees.'
/Pauses/
/He points the pen at [18]/
'Ok, what else is there?'
/Pauses, thinking/
/He seems to refer to the criteria list and briefly moves his pen as if ready to tick against criteria 1/
/He reads aloud [1] very quietly/
/Pauses, thinking/
/He turns to the computer/ 'Ok, that's it./Starts typing/

It is difficult to understand what makes Harry to infer that 'there are more arguments for paying tuition fees'. If he had reflected on color representation, he should have noticed that, as he had used the orange color correctly on textboxes 7 and 12 to define them as refutation, only the middle tree includes unrefuted counterarguments. The arrangement of the sub trees on the paper makes it more difficult to discern the existence of three separate trees (Figure 5.2), if compared with the neater arrangement computer-based version (Figure 5.3). The transcript shows that, although he reviews all textboxes, he starts reading from the top textbox only when reviewing the middle tree, i.e. reading [1], [16], [17], [18], [15]. This means that the middle tree is perhaps drawing more his attention and thus influencing his overview. It is possible that the configuration of the paper-based diagram confused the participant by giving him a poor overview of the balance of arguments and counterarguments. Harry's intention as he starts with a question is clearly to deliberate over his position. This is a case where the

diagram is used as medium for deliberation over the essay position. In other cases we will see the diagram as a means for analysing a more established position.

Moving on to linearization, Harry faces a complex linearization problem: he has to mentally negate the orientation of the diagram, and use the counterarguments as supporting arguments. The translation process shows that Harry introduces all the content of the diagram, and organises it in 5 paragraphs (paragraphs #2-#7, excluding introduction #1 and conclusion #8). He works across the 5 paragraphs, rather than finishing each one and continuing with the following. After transferring all the diagram content, he reviews the essay and realises that he has included too many counterargument.

/He looks at the criteria list/
'I need to start taking a clear position.'
/Pauses, reviewing the essay/
/He looks at either the criteria list or the diagram/
'Ok, it seems I have more points against tuition fees than I do for, so… I'm going to start taking a clear position.

He then restarts from the beginning of the composed draft and refutes most of the counterarguments by inventing new refutations. He fails to refute two counterarguments. The rational for grouping diagram content in paragraphs follows a left to right 'sweeping' of the diagram and not a thematic or other rationale.

As already mentioned in the previous section, Harry's semantic structure is improved thanks to eliminating weak refutation, and improving argument balance, and is deteriorated due occurrence of unrefuted counterarguments. Failing to overview the balance of argumentation during planning is more likely to have contributed to unrefuted counterarguments, especially given the complex and unruly linearization process. In contrast, the complex translation has motivated Harry to focus on inventing and developing refutation, which is possible to explain the improvement in argument balance, development in depth. He is no longer prompted to

invent refutation by the criteria list but by the emerging need to clarify his (new) position and to refute counterarguments. Regarding the reduction of digression, it was noted that during planning Harry was mindful of semantic associations between elements of the diagram plan, reviewing them often. And later during composing he is careful when inventing new content. On the other hand, moving backwards and forwards between paragraphs during translation did not help thematic continuity and paragraph organisation.

Overall, diagramming appears to confuse Harry during position deliberation. The role expressiveness of the paper-based diagram has not been adequate in supporting position deliberation. However, when faced with a complex linearization task he seems to set and focuses on a new goal. This is likely to have motivated him to focus on refuting counterarguments and develop them better than in the baseline essay.

5.5.4 Comparison of the Myside Bias group

Harry uses the method on paper. The observation that he has difficulty to estimate the balance of arguments in relation to the tentative position is important for discussing the differences between the paper and the computer based method in this group. The difficulty to overview the macrostructure of argumentation, and in particular the balance of arguments and counterarguments, is related to the less well-ordered arrangement of the paper based diagram. In comparison, the computer-based diagram did not confuse Charlie regarding his tentative position. In contrast, it helped him to organise his paragraphs thematically. The participant identified themes to be emerging from sub trees. The computer based method favoured the overview of the argument macrostructure.

On the other hand, while using the paper-based diagram Harry appears to be mindful of the semantic links between diagram textboxes, thus dealing with aspects of microstructure.

Responding to counterarguments during linearization also drew Harry attention to semantic links between existing counterarguments and new refutation. These observations suggest that the messy representation of the paper-based diagram limits the overview of the macrostructure and the role expressiveness of the notation in terms of conveying the argument balance. However, it does not distract from focusing on microstructure.

The smooth, uncomplicated translation of the computer diagram into text contributed to improvement of paragraphing and thematic continuity in Charlie's case. During linearization a diagram tree makes the boundaries and structure of a paragraph salient. However, the output of linearization is effective when it involves elaboration and expansion of the diagram content.

Harry does not rely on the diagram so much for organising his paragraphs. This is explained by the fact that his essay position is not the same as the diagram position. Dropping the tentative position should have motivated him to revise and restructure the diagram. Further cases like this are needed to confirm the viscosity of the paper diagram, or the argument diagramming method overall, to accommodate a changed position.

Overall, the improvement and increase in refutation is related in both cases to the use of argument diagramming. In the case of Charlie, it is directly related to the produced argument diagram. In the case of Harry it is related to position deliberation as result of extending the diagram content in the text. Improvement of rhetorical structure is also in relation to argument diagramming. In Charlie's case it is related to an adequate linearization strategy of developing the content of the diagram. In the Harry's case, argument diagramming sets for him new goals which are achieved through expanding the diagram ideas in the text.

Process of baseline essay		
	Charlie (PC)	**Harry (Paper)**
1. Type of plan	Content plan, for-against-rebuttal, not rhetorical, **weak semantic associations**	Simple list of points, including notes on introduction, **no semantic associations**.
2. Planning duration	11 min of total 1h 32 min	3 min of total 1 h 37 min
3. Plan entries	9	14
4. Ideas/arg. generation	Very brief notes on plan. TA is richer	As result of cr. list, during reviewing
5. Essay position	**No reflection**, position decided in the beginning of planning	**No reflection**, position decided in the beginning of planning
6. Criteria list (and engagement in argumentation)	Guides invention (planning). Guiding and confirming (writing)	Guides invention (planning)
7. Reflection on planning	N/A	N/A
8. Plan to text linearization	Plan as content reminder.	Plan as content reminder.
9. Rhetorical plan	Thematic titles and argument orientation subtitles in text	No rhetorical planning
10. Interleaving	N/A	N/A.
11. Revision	Language revision during writing, essay reading in the end	Language revision during writing, essay reading in the end
Process of posttest essay		
1. Type of plan	Computer-based	Paper-based
2. Planning duration	30 min of total 1h 29 min (+19')	18 min of total 1h 10 min (+15)
3. Plan entries	21 textboxes: 9 SUP, 6 CNTR, 5 REFT 5 trees, 4 max level	15 textboxes: 3 SUP, 6 CNTR, 5 REFT 3 trees 4 max level
4. Diagram content generation	By argument orientation (First supporting textboxes, then opposing, then refuting)	Mostly by association of ideas (zigzags between branches)
5. Essay position	Position taken tentatively in the beginning - top tree statement is neutral though	**Diagramming contributes to position deliberation**: top tree statement is a question
6. Criteria list (and engagement in argumentation)	Mainly confirming during planning and writing. Proactive engagement	Position item is guiding writing. Proactive & reactive engagement
7. Reflection on diagram	**Aware of 'vague' spots of diagram**	Position deliberation triggers **reviewing of argument balance** on diagram
Semantic connectivity of diagram	Some problems with weak or bad refutations	One unclear and one less relevant. Going in depth makes bottom textboxes less relevant
8. Diagram to text linearization	- Extended reflection on diagram - **Diagram is elaborated & expanded/- Problematic connections are rectified**	-**Diagram is elaborated & expanded /-Negating tentative position** of diagram in essay in view of many counterarguments
9.Rhetorical plan	Each sub tree is separate theme. Paragraphs correspond to trees. **Thematic titles only.**	Negating position and re-grouping textboxes.
10. Interleaving	N/A	N/A
11. Revision	Language revision during writing, essay reading in the end	Reorganising diagram content in text. Revising while composing

Table 5.6: Process measures for Charlie (PC) and Harry (Paper) from the Myside bias group

5.5.1 Concluding remarks for the Myside Bias group

The reviewed evidence has demonstrated that writers at this level of ability gain a lot from the engagement with the argument diagramming. A number of semantic and rhetorical gains were accomplished by the use of the method (Table 5.7). The semantic gains are mainly in the area of refutation 'content' that is the increase of the counter arguments, refutation, arguments and refutation moves in the text. It seems that the writers at this low level of ability realise, when they use the argument diagramming tool, the lack of non-supportive arguments.

They start spending more time in planning their essays, review the balance of arguments of different orientations, and invent more counterarguments and refutations. Better balance of counter versus supportive arguments and more refuting statements are the direct outcomes of these new behaviours. Another outcome is the reduction and elimination of weak refutation strategies with the writers spending more time on reflecting and editing the links between textboxes in the diagram and therefore spending more time on thinking through the weaknesses of their refuting statements.

However the implementation of the new approach does not come without challenges. The existing schema is strong and 'sticky', so it manages to survive even when the writer is trying the new approach. Not surprisingly, the exposure to the new method does not resolve more complex problems like the management of complex refutations and the low coherence between the included arguments and the main position of the essay.

As far as the rhetorical aspect of the essay is concerned, writers of the myside bias group manage to reduce the digressions, the repetitions and the unclear statements in the essay. Some manage also to improve the thematic continuity of their essay, although others still have poor paragraphing issues.

Semantic changes	**Associated Processes**		**ArgD**
Balance of supporting versus counter arguments improves	Diagram encourages position deliberation which in turn triggers reviewing the argument balance	PL	Paper
	Paradoxical use of the diagram: after developing supporting and counter arguments, position is inverted and ex-supporting arguments become counter arguments for the new position	PL	Paper
More refutation content	Increase planning time	PL	PC & Paper
	Introduces many counterargument and refutation textboxes	PL	PC & Paper
Weak refutation reduced or eliminated	Reflecting and careful editing of links between textboxes in the argument diagram	PL	PC & Paper
Problems with complex refutation (e.g. 2 refutation in the same paragraph) persist	Complex structure on diagram (including chain of refutation) is badly linearized	LN	PC
Low argument-position coherence (unrefuted counterarguments)	Difficulty to overview diagram formation, due to messy arrangement - too much focus on the centre of the argument diagram, writer loses sight of the links between sub-trees and the position	PL	Paper
	The inversion of the diagram between planning and translating damages the links between positions and identified arguments	PL LN	Paper
Rhetorical changes	**Associated Processes**		**ArgD**
Improved thematic continuity	Develop diagram tress which are then linearized into themes in the essay	LN	PC
Poor paragraphing persists	Linearization did not follow the structure developed by planning	LN	Paper
Deeper development of paragraphs & statements	Reflecting and careful editing of links between textboxes in the argument diagram enables to realise the value of connecting various arguments into a paragraph	LN	Paper
Reduced repetitive and unclear statement	Visualisation of "vague" spots on the diagram	LN	PC
Reduced digression	Diagram concentrates the writer to concrete rhetorical goals	PL LN	Paper

PL = Planning, LN = Linearization, Inter = Interleaving, WR = Writing
Green cells = improvement compared to baseline; Red cells = deterioration compared to baseline

Table 5.7: Text changes and associated processes in posttest essay in the Myside Bias group

Similarly, although some start to develop deeper paragraphs and statements in the essay, others still face problems of low depth. The drawing line between the two is related to the degree of reflection and the careful consideration they assign to argument diagramming, with those who try to copy and paste from the diagram to the essay, failing to develop statements of any noteworthy depth. As far as the rhetorical aspect of the essay is concerned, writers of the myside bias group manage to reduce the digressions, the repetitions and the unclear statements in the essay. Some manage also to improve the thematic continuity of their essay, although others still have poor paragraphing issues..

5.6 Low Pseudo-integration group

5.6.1 Low Pseudo-integration group: baseline text

Mary, Rea and Pandora are considered in the Low Pseudo integration group. In this group participants integrate counterarguments when expressing their position. However, in the main body of the essay, they elaborate more on arguments that support the position, they include far less counterarguments, and very few or unsuccessful refutations of counterarguments. In particular, the baseline essays of this group are characterised by the following aspects:

1. Essay position: Arguments of both sides of the debate are developed but the position of the essay (in the introduction or conclusion) is not taking into account both sides of the debate. The concluding position is moderated with a qualification, that is a reservation or a partial application of the position statement. For example “Students should pay tuition fees but fees should be lowered” (Rea) or “Students should pay tuition fees but a cap should be imposed” (Mary). The participants present each side of the debate separately and then in concluding they present the position and the condition.

2. The range of **argumentation strategies** includes the position-supporting strategy and adversarial strategies, that is, countering the position and refuting counterarguments.

3. Argumentation balance: Argumentation supporting the position outnumbers countering and refuting argumentation. Refuting argumentation is developed much less than countering.

4. Argument-position coherence: At some passages it is difficult for the reader to discern what the writer's position is.

5**. Integration strategy issues:** While there is clearly intention to integrate counterarguments in the position, counterarguments are developed limitedly in the main body of the essays and are not always integrated successfully.

5.6.2 Low Pseudo-integration group: text change

The posttest essays of Mary and Pandora improve considerably in terms of semantic structure, while Rea's improves less (Table 5.8). Rea improves by enhancing just the refutation strategy. In the case of Mary (Table 5.9) and Pandora (Table 5.10) the main improvement consists of widening the range of argumentation by introducing, along the refutation strategy, the weighing and weighing-minimization strategies, thus introducing some conciliatory strategies. Conciliatory strategies integrate counterarguments by reducing the strength of countering moves (minimization strategy) rather than refuting them (adversarial strategies), by weighing out advantages and disadvantages and justify an inclination to either (weighing), or by identifying under which conditions a counterargument can hold (synthesis-contingent). Including successfully both adversarial and conciliatory strategies indicates more effective integration of arguments and counterarguments – consistently with Nussbaum's framework (Nussbaum, 2008; Nussbaum & Schraw, 2007).

Pseudo-integration Low	Mary (PC)		Pandora (Paper)		Rea (PC)	
Semantic argumentation parameters in baseline essay	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
1. Essay position: taking into account both sides of the debate	√	√	√	√	√	√
2. Range of integration strategies : countering position and refuting counterarguments (adversarial)	√	**reaches PI high**	√	**reaches PI high**	√	√
3. Argumentation balance: supporting argumentation outnumbers countering, few refutations	√	**more [12] balance**	√	**more balance**	√	√
4. Argument-position coherence : difficult to discern writer's position at times	√	**reaches[13] PI high**	√	**reaches PI high**	N/A	N/A
5. Integration strategy issues: counterarguments developed limitedly and not always successfully refuted	√	**reaches PI high**	√	**reaches PI high**	N/A	N/A
Rhetorical argumentation parameters in baseline essay	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
A. Rhetorical structure organisation issues: Thematic structure, argument orientation structure	√	√	N/A	N/A	N/A	N/A
B. Juxtaposition: paragraphs or arguments juxtaposed without being weighed out	X	√	N/A	N/A	N/A	N/A
C. Development of depth: Shallow development of paragraphs or statements, short paragraphs, abrupt switching between argument moves and chains	√	√	X	√	N/A	N/A
D. Relevance: Digression/Topic drift, Unrelated statements	√	**more**	N/A	N/A	N/A	N/A
E. Clarity: Unclear statements	N/A	N/A	N/A	N/A	N/A	N/A
F. Repetition: can be related to refutation or supporting arguments.	X	√	N/A	N/A	N/A	N/A
KEY: BASL: baseline, ARG.D.: posttest, √ confirms existence of element, X shows absence of element, green shade: improvement, red shade: deterioration						

Table 5.8: Low Pseudo-integration group progress in argumentative text

[12] Support and Counter arguments more balanced: Support arguments reduced, Counterarguments increased
[13] There are no inconsistencies between the position and the developed argumentation

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	62	50%	11	42%	2	Intro	POSITION	1		
CNTR	21	17%	7	27%		Support	SUP	2	Unrelated	1
REFT	25	20%	6	23%	2	Refutation	CNTR-**REFT**	1		
NEUT	7	6%	1	4%		Refutation-weak	CNTR-**REFT**	1	Weak refute	2
NF	8	7%	1	4%		Concluding	POSITION	1		
Total	**123**		**26**		**4**	Total		**6**		
Posttest										
SUP	59	45%	18	45%	2	Intro	POSITION-QUAL.	1		
CNTR	51	39%	17	43%	3	Support	SUP	1	Weak support	1
REFT	11	8%	3	8%	1	Refutation	SUP-CNTR-**REFT**	1	Unrelated Drift/digress	1 1
NF	9	7%	1	3%		Weigh minim.	SUP-CNTR	1		
NEUT	1	1%	1	3%	1	Weighing	SUP-**CNTR**-REFT	3	Repetition	2
Total	**131**		**40**		**7**	Juxt adv-disadv	**SUP**-CNTR	1	Weak support	1
						Concluding	POSITION-QUAL.	1		
						Total		**9**		

Table 5.9: Baseline and posttest essay of Mary (Low Pseudo-integration, PC)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	51	57%	12	60%	2	Intro	POSITION-CONT.	1		
CNTR	16	18%	5	25%	1	Support	SUP	2		
REFT	13	14%	1	5%	1	Counter unrefuted	CNTR	1	Weak support	1
NEUT	0	0%	0	0%		Refutation-deep	CNTR-**REFT**	1		
NF	10	11%	2	10%		Concluding	POSITION	1	Weak support	1
Total	**90**		**21**		**4**	Total		**6**		
Posttest										
SUP	55	49%	14	39%	2	Intro	POSITION-CONT.	1		
CNTR	41	37%	14	39%	2	Support	SUP	2	Weak support	1
REFT	15	14%	7	19%	3	Weigh min.	SUP-**CNTR**	1		
NF	0	0%	0	0%		Weighing	SUP-**CNTR**	1		
NEUT	1	1%	1	3%		Problem solution	CNTR-**REFT**	3	Weak solution	1
Total	**107**		**34**		**7**	Concluding	POSITION	1		
						Total		**9**		

Table 5.10: Baseline and posttest essay of Pandora (Low Pseudo-integration, Paper)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	69	52%	18	56%	2	Intro	NEUTRAL	1		
CNTR	38	29%	10	31%	2	Support	SUP	2		
REFT	8	6%	2	6%	2	Counterargument	CNTR	2		
NEUT	0	0%	0	0%		Refutation	SUP-CNTR-**REFT**	2		
NF	17	13%	2	6%		Concluding	POSITION-CONT.	1		
Total	**132**		**32**		**6**	Total		**8**		
Posttest										
SUP	70	57%	20	56%	3	Intro	POSITION	1		
CNTR	19	16%	9	25%		Support	SUP	3		
REFT	30	25%	6	17%	3	Refutation	CNTR-**REFT**	2		
NF	0	0%	0	0%		Refutation-deep	SUP-CNTR-**REFT**	1		
NEUT	3	2%	1	3%		Concluding	POSITION-CONT.	1		
Total	**122**		**36**		**6**	Total		**8**		

Table 5.11: Baseline and posttest essay of Rea (Low Pseudo-integration, PC)

Related to the improvement of counterargument integration is that Mary's and Pandora's essays improve in argumentation balance (Table 5.8, semantic structure, item 3), namely counterarguments are more balanced with supporting arguments in the posttest essay. In relation to dealing with integration strategy issues (Table 5.8, semantic structure, item 5), they both improved the application of refutation strategy: weak refutation is eliminated in Mary's case (Table 5.9), and unrefuted counterargument is eliminated in Pandora's case (Table 5.10). The two participants also improve in terms of argument-position coherence (Table 5.8, semantic structure, item 4), as the developed argumentation reflects better the position throughout the essay.

Conciliatory strategies characterise the high level of pseudo-integration, therefore Mary and Pandora's essays advance to this level. Rea, on the other hand, advances within the low Pseudo-integration level. In Rea's posttest essay adversary strategies are enhanced as the refutation moves increase considerably (Table 5.11).

While Mary and Pandora improve in similar way in terms of semantic structure, they do not in terms of rhetorical structure. Mary's baseline essay shows some problems in the posttest essay, Pandora's essay has fewer, and Rea's none. Mary's essay deteriorates in terms of rhetorical structure (lower relevance of arguments and emergence of some repetition). In Pandora's essay the rhetorical structure deteriorates slightly by getting worse in one aspect of rhetorical structure (low depth) while Rea's essay rhetorical structure is not affected (Table 5.8).

5.6.3 Low Pseudo-integration group: process change

Mary's and Pandora's posttest essays improve in that argumentation strategies include, along with refutation, weighing and weighing minimization strategies.

In Mary's baseline essay the main strategy used in the text is to support the position and to refute counterarguments. Refutation is applied successfully when a simple structure is adopted. However, when the participant integrates more than one counterarguments and refutations in a complex structure (chain), the flow between arguments of different orientation is not smooth. Argumentation moves are not adequately developed (e.g. paragraph #4 below):

> *The main argument for free tuition fees at undergraduate level is to make it fairer for those who can't afford to attend university. Currently, there is a loan system in place to financially help everyone attending university. However, the amount of debt people come out of university with is off-putting to those who wish to study in higher education. Although the loans will cover accommodation and tuition fees, it will not cover extra expenses, such as food if the student is not catered, socializing, an instrumental part of the student lifestyle, clothes and other such extras. Those who are poorer do not want to have this huge debt hanging over their head before they even begin working full-time. Yet, the government has a system in place to make sure that the debt does not have to be paid back, until one is earning a certain amount. This helps to make sure people have the chance to 'get on their feet' so to speak, rather than being bogged down in debt as soon as they leave university. Also it is argued why should the government fund a student's social life. The student could easily get a job before and during university to fund their upkeep, whilst the government loan pays for tuition and accommodation. If free tuition was to be introduced it would have to apply to everyone to be fair. This would include those that can afford to pay for university, and if people can afford to pay for their university education there is no reason they shouldn't. This shows how, although being hugely beneficial, scrapping tuition fees is not practical." (Mary, baseline essay)*

This problem of development of depth is related to a poor translation process. Analysis of the planning process of the baseline essay shows that, although Mary plans extensively, when she engages in both content and rhetorical planning, she adopts a poor translation strategy (see Table 5.12 for details and process measures). First, she generates an initial content plan, a messy plan drawn on paper, which includes mostly supporting points and much fewer countering and refuting points. After typing a short introduction, where she takes a synthesis position, she also types an outline. There, she includes the content of the paper-based plan, loosely re-organises the content under three themes, expands on the supporting arguments, but not on the counterarguments and refutations. The outline is deleted as its content is being translated into the essay. A couple of new ideas that occur to her while composing (interleaving) are added randomly on the paper diagram. When translating the outline into text, she follows an erratic process: she inserts sentences, switches between paragraphs to edit passages, performs word counts, and leaves argument moves unfinished. It is difficult (for the analyst) to identify the goal of translation sub processes. This is more noticeable when she composes the complex structure mentioned above. Overall, the outline serves up to a point the linearization of the messy plan but does not help with developing and clarifying countering and refutation moves. Although Mary has set herself the goal of countering and refuting she lacks an adequate strategy in delivering this in writing. Practically, the current translation strategy deprives her for the possibility of interacting with both the outline plan (as is deleted). Procedurally, she is lacking in organization skill, i.e. to set clear goals and systematically pursue them.

Pandora's baseline essay and process bares some differences and some similarities with Mary's case. In terms of text, Pandora, like Mary, includes counterarguments, but unlike Mary, she refutes only some of them. In terms of process, Pandora adopts a two-stage

planning: a content plan which is then carefully reorganised as an outline. Unlike Mary, she adopts a more organized translation process, expanding on the content of the outline and moving gradually from paragraph to paragraph, but does not pay attention to refuting counterarguments and the relation between position and argument moves.

In particular, there is only one refutation move, in Pandora's baseline essay. Observation of the planning process shows that refuting counterarguments is not one of Pandora's main goals. This is consistent with her hesitation in ticking the relevant item in the criteria list. Furthermore, although Pandora is concerned with defining her position during planning she seems unsure about her position. The following transcription passage is after the end of the planning process and includes text passages of the introduction paragraph:

> /She starts typing/
> <<Currently students are faced with huge debts by the time they eventually finish their>>
> /she looks at plan, she is copying ides from the plan/
> <<degrees simply due to the rising cost of tuition and the need for student loans. By removing tuition fees there would be both advantages and disadvantages>>
> /pause/
> << to both the universities and the students themselves, for example less stress for students but more overcrowding in the universities. In this essay I hope to explore both the pros and cons of removing the tuition fees and >>
> /looks at plan/
> 'what else do I want to do? argue that... I don't really know what I do, I don't really take a side I am kind of doing both pro and cons'
> <overall come to the conclusion that>
> /pause/
> < there is a need for tuition fees, however they should not be at the price>
> /pauses trying to rephrase the last word/
> <as expensive as they currently are.>

Contrary to Mary, Pandora's planning process does not help to formulate her position not to gain an overview of the balance of her arguments.

Another difference with Mary is that Pandora's baseline essay has very few problems in relation to the rhetorical structure. The simple structure of the text, including paragraphs with statements of the same orientation, mainly supporting the position explains the relatively flawless rhetorical structure. The clearer translation process may also be related to another reason: Pandora develops her arguments more during content planning, expanding the points of the initial brainstorming phase, before translating them in outline and then in text. Pandora's translation process, unlike Mary's, follows closely the outline content and order, focusing at one paragraph at a time and finishing argument moves before moving on.

Rea adopts a simple and succinct planning process and an elaborate translation process. The plan, a two column list of 'for' and 'against' arguments, is not messy at all, and shows a relation between an argument 'for' and an argument 'against'. She is guided by the criteria list to consider refutation moves during planning. In terms of structure, the paragraphs are well linked in a subordinate structure. Rea could be considered a more competent writer than the other two in this group. She composes an essay of similar length than the other two but in less time and with no issues regarding the rhetorical structure parameters.

In Mary's *posttest* essay, the overall time spent on planning does not increase noticeably, but the planning process changes. The participant engages extensively in generating counterarguments and refutations while using the *Rationale* software during planning. In particular, time invested in invention of ideas with the support of the Rationale diagram increased significantly to 30 minutes (from 7 in the baseline), producing a very extended diagram of 57 textboxes. Mary engages for the longest time of the 3 in argument diagramming and produces the largest diagram amongst the 16 participants. The semantic associations between textboxes are meaningful and the notation is used consistently. After diagramming Mary engages in rearranging the diagram textboxes in order to thematically

regroup them, and thus organises the content and order of paragraphs. Additionally, before writing the participant typed a separate outline based on the themes of the diagram but in much less time than in the baseline essay (5 minutes).

The weighing and weighing- minimization strategy that the participant employed throughout the essay could be explained through the diagram overview. Figure 5.4 shows a simplified version of the actual 57-textbox diagram. The argument chains include many counterarguments that have not been refuted. While in previous case, unrefuted counterarguments made the participant review and change his position (Harry), here, they

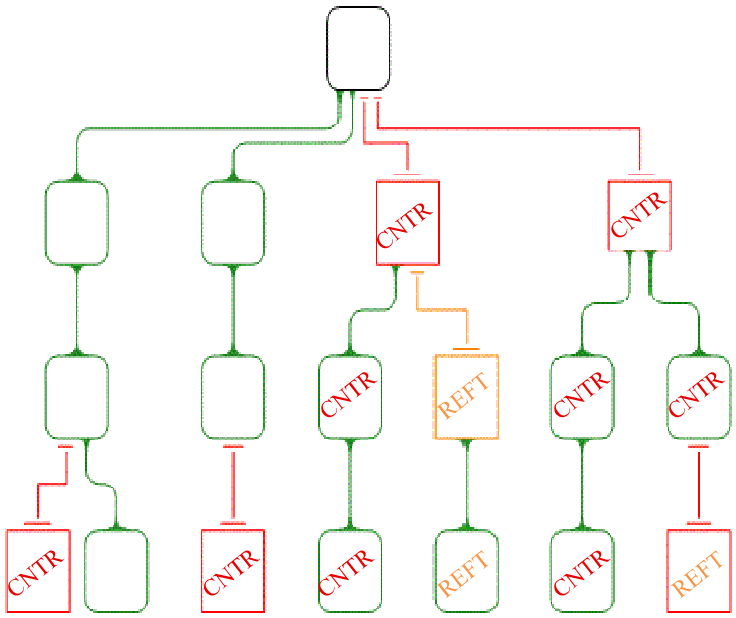


Figure 5.4: Simplified representation of argument diagram produced by Mary with the Rationale software

seem to trigger a different approach. Counterarguments are integrated in weighing and weighing-minimization strategies, they are presented as advantages or disadvantages in a course of action or approach that are minimized by exceptions or limitations. This is of particular interest. First, it shows, that similar diagram formations trigger different strategies to participants. This maybe related with the observation that Mary deliberates on her position while she works on the diagram, i.e. she does not start with a firm position. Whether the

writer intends to use the diagram in order to deliberate on her position or to analyse it contributes to how she interprets the diagram. Second, it shows that a red counterargument may, on one side of the diagram trigger a refutation strategy (the right side) while, on another it may not. Different strategies become salient on different sites of the diagram.

However during translation Mary does not elaborate on the content of the diagram. She does not develop the ideas further nor revises them while she writes. She included the entire diagram content in the essay, and followed very closely the diagram structure, parsing the argument sub trees from top to bottom, following a less erratic translation process. A possible reason for lack of transformation and revision of the diagram content may be related to the difficulty of managing the extended diagram. The participant struggled to transfer the content of the diagram in the essay by copying and pasting the text from the textboxes individually, and then colour coding them as in the diagram. Half way through the essay she abandoned the copying and colouring practice and continued by simply looking at the diagram. The participant had to zoom in and out many times to gain a good overview of the diagram. While transferring the diagram content in the essay she 'folded up' the argument trees in a manner denoting that she covered them in the essay.

In the same way as Mary, Pandora's posttest essay improves in that counterarguments increase considerably. Additionally, the range of argumentation strategies widen and include both conciliatory and adversary strategies. An interesting finding is that the Pandora's diagram (Figure 5.5 and Figure 5.6) is similar as that of Mary's (Figure 5.4): it includes some unrefuted arguments and some refuted ones. Pandora's paper-based diagram (Figure 5.5) is transcribed and annotated (Figure 5.6) to facilitate the representation of linearization processes. The paragraph presented below is generated from the translation of one of the sub trees, where an unrefuted counterargument is integrated in a weighing strategy (Figure 5.6 sub

tree #2 with stronger dotted line contour). The words highlighted in the passage are also seen in the diagram.

> *Since the internet is accessible all over the world, it's possible for anyone to join such social networking sites as facebook. By speaking to people from other cultures, there is potential to gain an understanding of different cultures through first hand experience. I think first hand experience is very important for youth being taught today, and also for the older generations who might not know much of other cultures, since they are able to connect directly to the point of learning. Although many of the people on facebook would give an accurate picture of some cultures, they will probably only represent a very small portion of a population. This could lead to unrealistic representations of societies. The only condition of the societies which can be learnt about is that they require having access to the internet. So people may be learning of new societies, but they won't be learning about, for example, 3rd world countries or those simply less privileged, so it is not entirely beneficial. Paragraph#2: (Pandora, posttest essay)*

In the text, the writer first develops the advantage, then highlights a disadvantage, and concludes by showing that the advantage presents a limitation. The example shows also how much the writer expanded the content of the diagram, developed the arguments further, and most importantly integrated the counterarguments in a successful strategy, the weighing strategy. The weighing strategy appears to become salient in this case too as result of reflecting on and linearizing the specific structure of the diagram.

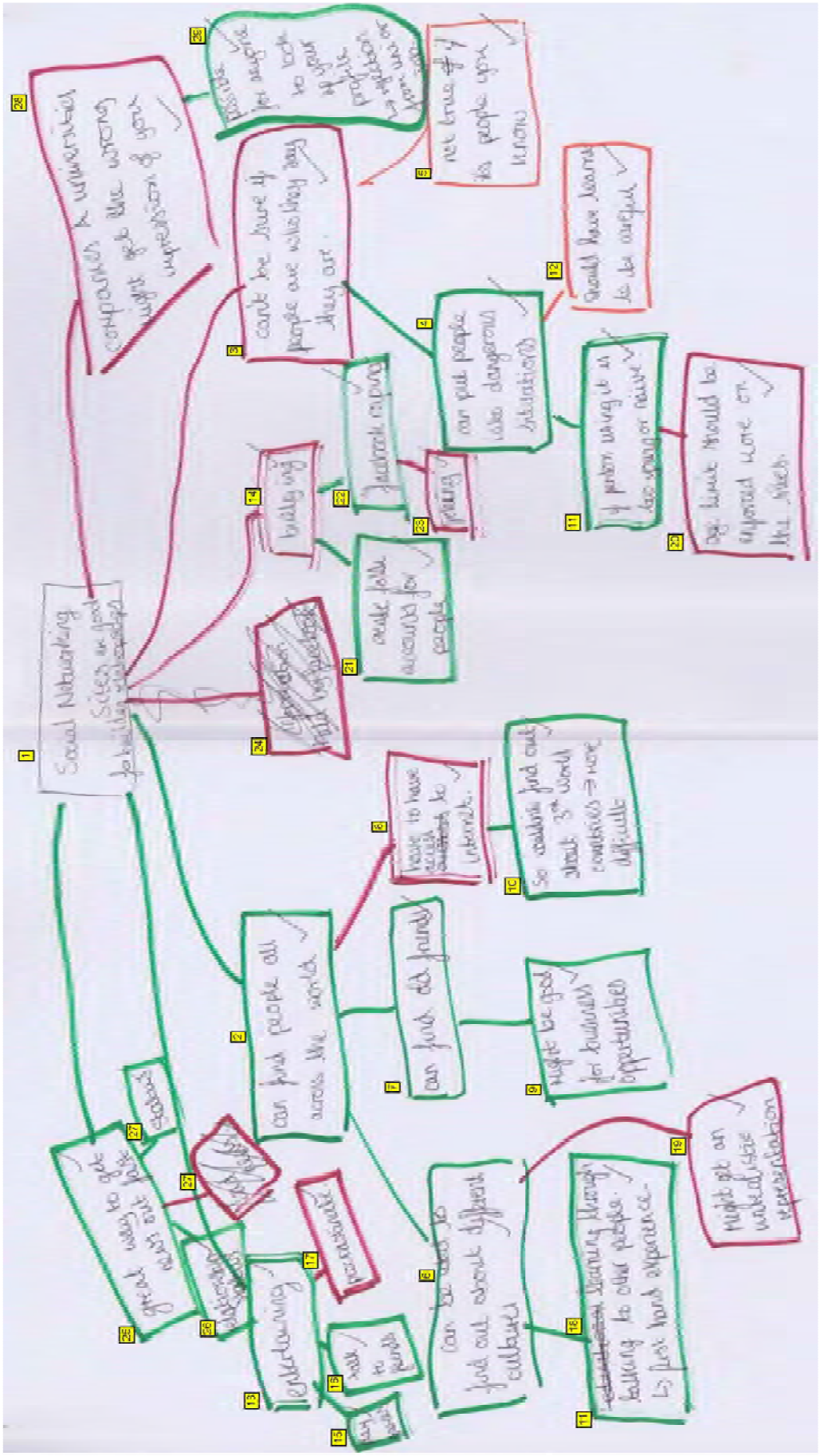
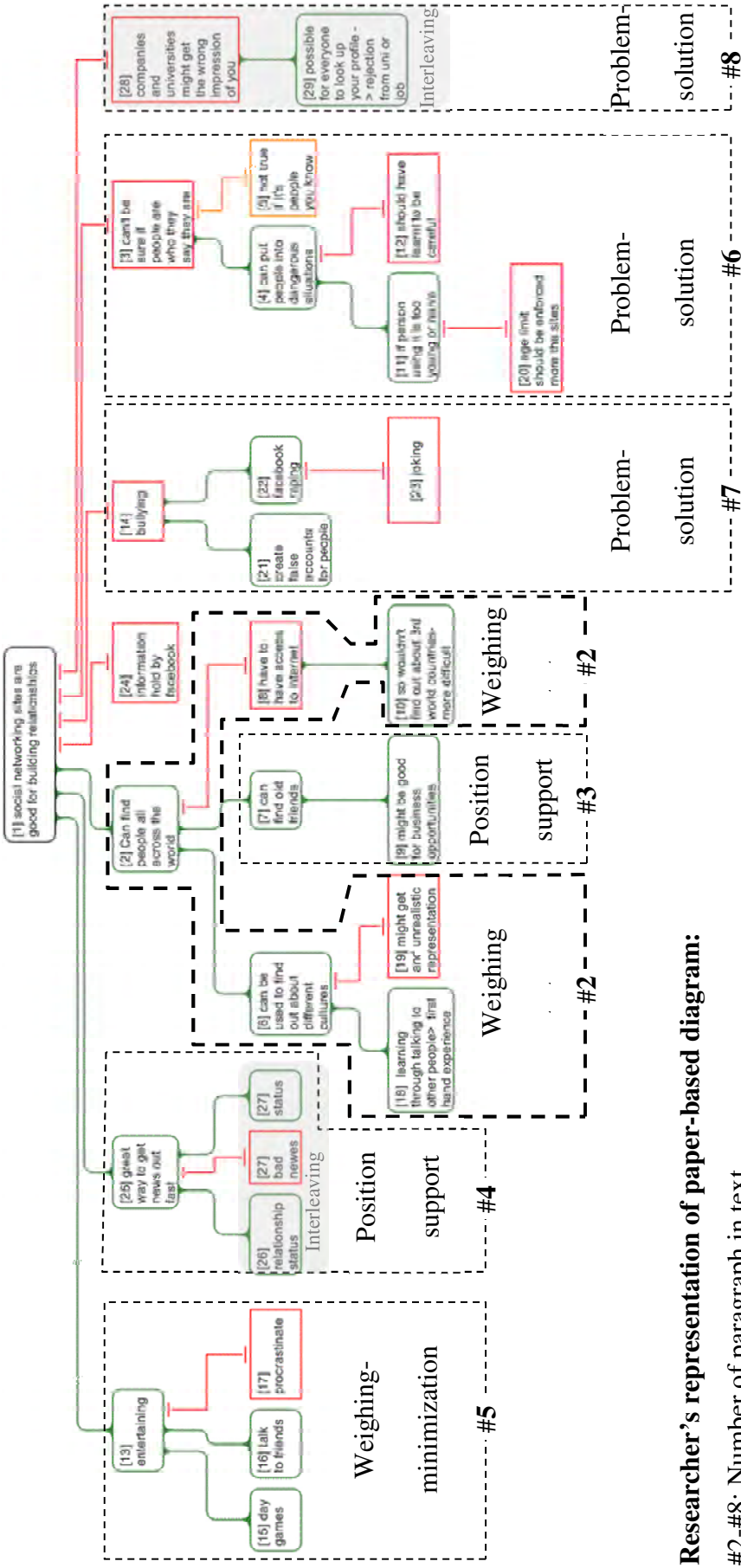


Figure 5.5: Pandora' paper-based argument diagramming



Researcher's representation of paper-based diagram:

#2-#8: Number of paragraph in text

Dotted outline: grouping of textboxes in paragraphs during diagram translation

Argumentation strategy per paragraph: As characterised by text analysis

Shaded area: (Interleaving) textboxes added during writing

Figure 5.6: Pandora paper-based argument diagramming; transcribed and annotated for illustration purposes

Pandora carefully organised the text paragraphs around the diagram trees (Figure 5.6) adding content while writing. Furthermore, she left out of the essay two textboxes (24 and 27) literally crossed out from the diagram (Figure 5.5)

Translation is Mary's main weakness in the baseline essay. Using the computer-based method changed but did not improve the translation process. Her text presents repetitions, weakly related statements and topic digressions in the posttest essay, which are related to bad translation of the diagram content. The main gain in Mary's essay is how the argument diagram orientation, and in particular unrefuted counterarguments, are translated in the weighing and weighing-minimization strategies. These however, are not always translated successfully. The juxtaposition of advantages and disadvantages shows an unsuccessful attempt to weigh and compare arguments and counterarguments.

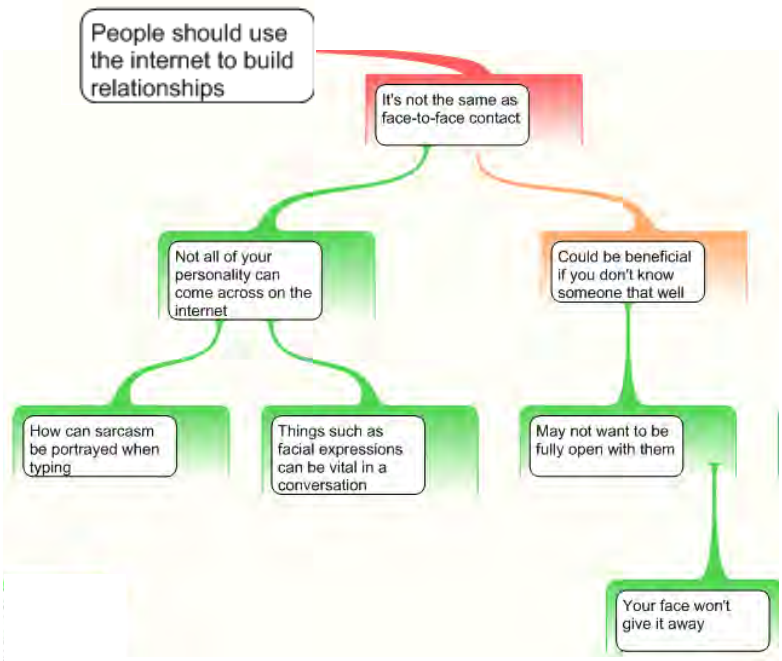


Figure 5.7: Extract from Mary's diagram

The problem in the extract is with the concluding statement.

> *Building a relationship on the internet does not equate to a relationship built face-to-face. It has already been seen that it cannot portray all of your personality, and this is furthered in the importance of seeing and hearing each other in conversation. Things such as sarcasm, which may be a fundamental part of your personality which cannot be accurately depicted on the internet. Also facial expressions seem to be underrated, as often these contribute to a conversation greatly, as they can give away what one really thinks. Nonetheless, this can be beneficial with someone you do not know so well, as you may not be ready to be fully open with them yet. Here it can be seen how although it is useful not to have to fully be open with someone, it does not truly represent you. Paragraph #7 (Mary, posttest essay)*

Another point that emerges from the comparison of the two text passages is the difference in translation. Pandora develops further the content of the diagram making the content of the paragraph to flow better concluding with a sentence that shows the weighing impact 'So it [learning about other countries cultures] may not be entirely beneficial'(In paragraph #2). In Mary's essay, it is not clear whether Paragraph #7 supports

Turning now to the third participant, an intrusting finding in Rea's process is that she starts her planning with a paper-based content plan, a two-column 'for' and 'against' plan (Figure 5.8) before engaging in argument diagramming. The second interesting finding that emerges from Rea's process analysis is that the unrefuted counterarguments of the diagram do not motivate her neither to review her position nor to adopt a weighing strategy. Instead in Rea's posttest essay, the number of refutation moves increases considerably. Rea adds refutation

moves during the composing process, thus responding to existing and some new counterarguments.

A question is raised as to why Rea's argument diagram did not prompt her to introduce a weighing or other conciliatory strategies. Rea spends most of her time during engaging with argument diagram in transferring the points from her two column list. Then she expands on these and adds a few more supporting points. She develops points 1 to 16, which are supporting points before engaging with counterarguments. The whole planning process does not differ much from that of her baseline where she developed a two column list, i.e. first make points 'for 'and then make points 'against'. Second, from the overview of her argument diagram we can observe an overwhelming supporting side. This is perhaps why she takes an one sided position as soon as she starts her introduction

Overall, Rea does not engage in the argument diagramming method as vigorously as the other two participants of the group.

5.6.4 Concluding remarks for the Low Pseudo-integration group

The reviewed evidence has demonstrated that writers at this level of ability achieved similar semantic gains with the last group (increase counterarguments and get a more balanced essay, increase in refutation etc.) (Table 5.14). The most interesting element is that the engagement of this group with argument diagramming has given them the opportunity to widen their argumentation strategies and include strategies that are more conciliatory. The argument diagram made the representation of weighing and weighing-minimization strategy salient without obscuring the role expressiveness of the diagram with regards the refutation strategy. The use of the diagram as a deliberation means in the planning process is noted here as important. The visibility of the diagram components, e.g. colour and associations, helps to

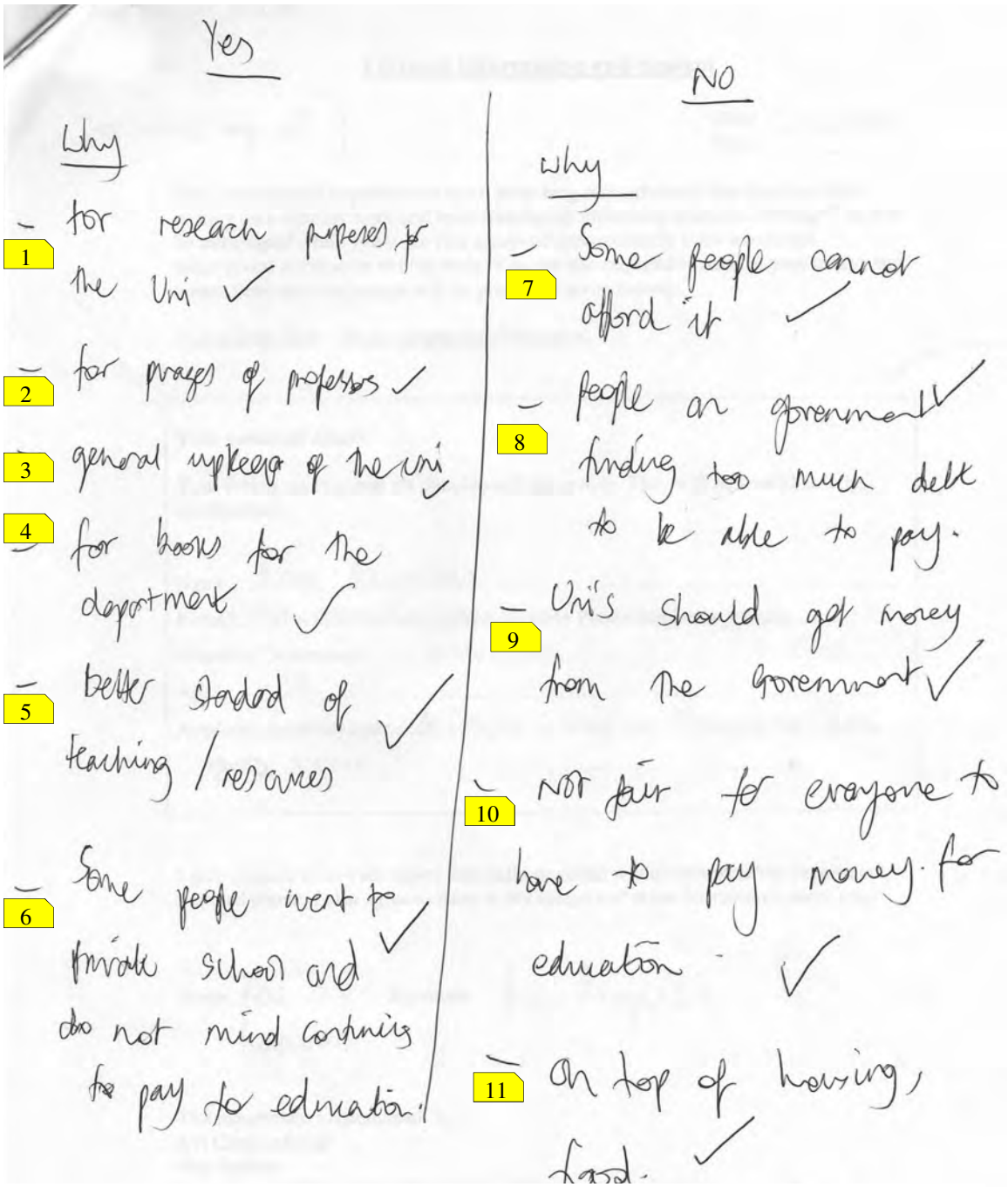
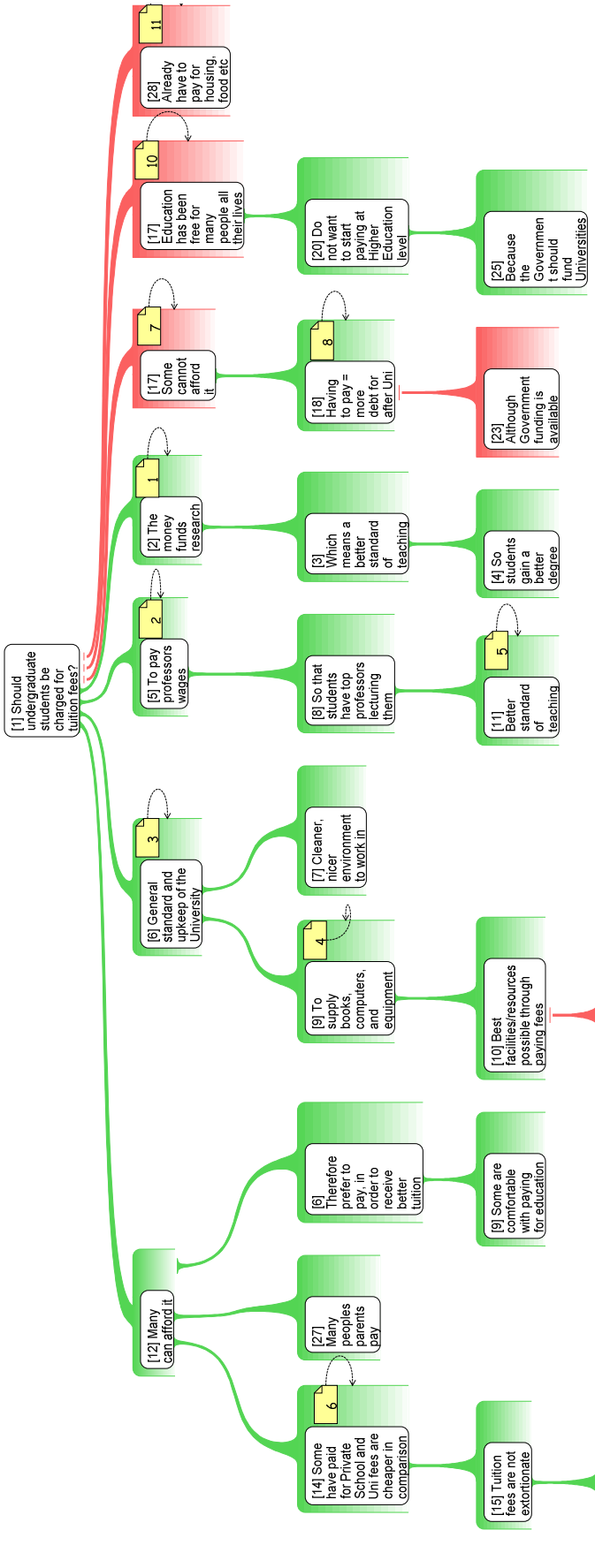


Figure 5.8: Content plan produced before argument diagramming with Rationale software (Rea)



Labels in yellow are the numbered points transferred from the content plan (Figure 5.8)

Figure 5.9: Argument diagram produced after content plan shown in Figure 5.8 (Rea).

Process of baseline essay			
PARTICIPANT	Mary	Pandora	Rea
1. Type of plan	a) Content plan – brainstorming: includes supporting, countering and refuting b) Outline grouping content thematically, argument orientation less important	a) Content plan – spider diagram: brainstorming & developing points, 'pro', 'con' and 'neutral', no refutation b) Rhetorical plan: introduction, conclusion and summary for 4 paragraphs, one refutation	a) Content plan-Two list column 'for' and 'against', clearly structured plan b) no rhetorical plan
2. Planning duration	a) 7 minutes b) 21 minutes of total 1:54 minutes	a) 10 minutes b) 8 minutes of total 1:25 minutes	a) 6 minutes of total 1hour
3. Plan entries	18 initial entries, 3 added during outline and 2 added during writing	19 entries, one added while editing outline	12 entries, 6 'for' and 6 'against'
4.Ideas/argument generation	Brainstorming on content plan; theme elaborating on outline	Generating 'pro', 'con' and 'neutral' points and developing some of them	Generating 'for' and 'against' in full sentences
5. Essay position	a) explores both sides of debate b) position defined at start of outline	Position formulated after completing outline	Balance between 'for' and 6 'against' visualised. Position defined during writing
6. Criteria list	Confirming – familiar with countering and refutation strategies	Confirming – very hesitant with refutation item	Confirm in the beginning. The refutation and conclusion item guided composition
7. Reflection on planning	Reflecting on paper-based content plan while producing outline	Reflecting on content plan while producing outline, concerned about position	Reflecting on essay question during producing of plan
8. Plan to text linearization	Text is composed erratically, switching between paragraphs, without following closely the content plan or outline	Composing follows closely the outline content and order, focusing at one paragraph at a time.	Focusing at one paragraph at a time, follows a rational of presenting both sides of the debate, position draws on both
9. Rhetorical plan	Thematically grouping content plan. Argument structure of content plan not preserved	Grouping content plan points based on argument orientation. Follows a pro, con structure.	No rhetorical plan
10. Interleaving	Adding notes on diagram twice during writing	Adding point on diagram while editing outline	None
11. Revision	Extended language and structure revising during writing without considering plan, no final revision	Language revision during writing, superficial revision, essay reading in the end	Language revision during writing, superficial revision, essay reading in the end

Table 5.12: Process measures of the Low Pseudo-integration group (Mary, Pandora, Rea) during the composition of the baseline essay

Process of posttest essay			
PARTICIPANT	Mary	Pandora	Rea
1. Type of plan	Computer-based	Paper-based	Content plan, paper-based & computer-based
2. Planning duration	a)30 minutes argument diagramming b) 7 outline minutes of total 1:51 min.	a)12 minutes, then 5 minutes more (interleaving) of total 1:22 minutes	a) Content plan, 3 minutes b) computer-based 13 minutes of total 1:09 minutes
3. Plan entries	57 textboxes, 21 support, 22 counter, 11 refutation, 5 trees, 5max level	27 textboxes, 11 support, 13 counter, 3 refutation, 6 trees, 3 max level	28 textboxes, 19 support 7 counter, 1 refutation, 6 sub trees 4 max level
4. Diagram content generation	Mainly developing each tree from top to bottom, few additions between branches	Switches between sub trees, then develops lower levels (Zigzag)	Switches between sub trees, then develops lower levels (Zigzag)
5. Essay position	Diagramming contributes to position deliberation	Diagramming contributes to position deliberation	Position most probably formed before argument diagramming
6. Criteria list	Confirming	Confirming	Confirming
7. Reflection on diagram	Concerned about thematic organisation and semantic links. A lot of rearranging takes place.	Pronouncing linking words (e.g. because) while reviewing diagram. Counterargument generated after supporting argument	Transferring points from content plan and developing some of them. Only one refutation introduced
Connections of diagram	Good connectivity, good use of notation	Good connectivity, good use of notation	Acceptable connectivity, minor issues: question, two misplaced textboxes
8. Diagram to text linearization	Extended reflection on diagram Not expanding on diagram content	Extended reflection on diagram Expanding considerably on diagram content	More extended during translation and paragraph organisation
9.Rhetorical plan	Thematic outline, theme emerging from diagram trees	No rhetorical plan	No rhetorical plan
10. Interleaving	None	Twice in order to add diagram content and to support existing argument	Once adds point to paper-based diagram and then to computer-based

Table 5.13: Process measures of the Mary, Pandora, Rea during the composition of posttest essay

effectively overview the balance of arguments. Another important impact of the method is on the proportion of time dedicated to content generation and outline of the essay (little time to content generation in baseline as opposed to large proportion of planning time in posttest essay).

The least improvement is observed in one of the participants' process who did not diversify much his planning process. The persistence of the existing schema is demonstrated by this writer who used both his own method of planning (no doubt driven by her current schema) as well as the new method of planning, although it must be admitted that such a combinative approach may be a facilitative strategy for the writer's development.

Finally the new method and the guidance it provides helped one of the writers to impose some structure on the planning method, moving from erratic linearization and random switching between paragraphs to something much structured. This has enabled her to handle better the more complex argumentation structures.

There are a number of side-effects that the interaction with the method brings forward. The increase of refutation content comes at the expense of counterarguments while digression, unrelated statements and repetition also increase, probably an inevitable price to pay for experimenting with new (and more demanding) argumentation strategies.

Research has revealed clashing accounts of the impact of the method on the depth of the developed arguments. The writer who selected a gradual approach, i.e. first develop the arguments in argument diagramming plan and then expand during linearization, manages to increase the depth. In contrast, the writer who went straight for a very large and demanding plan has remained at low depth of arguments.

Semantic changes	Associated Processes		ArgD
Much better balance between support and counter arguments by increasing the counter arguments	The use of the diagram prompts to increase considerably the time dedicated for inventing content, the first stage of planning (before the outline stage)	PL	PC & Paper
Small increase of refutation	Argument diagramming is used as an additional mechanism in between her own planning and the translation process – the use of argument diagramming adds refutations	PL	PC
Refutation increase at the expense of counterarguments	User does not engage with the argument diagramming method – she uses her own planning method and then transfer (some of) the points to the argument diagramming plan	PL	PC
Widening of integration strategies to include conciliatory strategies such as weighing and weighing minimization	Use of the diagram for position deliberation results on weighing supporting and countering arguments rather than refuting counterarguments	PL	PC & Paper
Paragraphs of arguments are juxtaposed without being weighed out	The writer makes the decision to weigh out but she ends up with juxtaposition because she lacks the implementation strategy	LN	PC & Paper
Better handling of complex argumentative structures (chains of several counterarguments or refutations)	The writer follows the diagram structure to translate into essay, that changes the erratic linearization such as switching between paragraphs etc. observed in baseline writing	LN	PC
Rhetorical changes	**Associated Processes**		**ArgD**
More development of depth	The representation of linearization is facilitated by argument diagramming	LN	Paper
	The writer uses the content of argument diagramming as a first base and then she expands the arguments further during linearization process	LN	Paper
Depth of arguments remain low	The use of argument diagramming changed but did not improve the translation process, probably due to the vary large size of the created diagram	LN	PC
Increased digression, unrelated statements and repetition	The use of argument diagramming changed but did not improve the translation process, probably due to the vary large size of the created diagram	LN	PC

PL = Planning, LN = Linearization, Inter = Interleaving, WR = Writing
Green cells = improvement compared to baseline; Red cells = deterioration compared to baseline

Table 5.14: Text changes and associated processes in posttest essay in the Low Pseudo-integration group

5.7 Middle Pseudo- integration group

5.7.1 Middle Pseudo-integration group: baseline text

Ann, Sheila, Antony, and Harriet are considered in the Middle Pseudo-integration group. Their baseline essays include counterarguments more extensively that the previous groups, and in particular, the countering argument moves are introduced as much as the supporting arguments (see baseline section of Table 5.16 - Table 5.19). The strategies employed to integrate counterarguments are mainly adversarial. The position of the essays, as expressed in the introduction or the conclusion, is either unclear or does not reflect the integration of counterarguments, which takes place in the other paragraphs of the essay. The unclear position, in combination with continuous alteration of short undeveloped argument moves, changing from supporting to countering to refuting moves, without clearly denoting the change of orientation, confuses the reader. More specifically, the baseline essays of this group are characterised by the following aspects:

1. Essay position. The writer's position stated either in the introduction or the conclusion, is absent, unclear, or hinted. In effect the writer presents both sides of the controversial issue without taking sides. When the writer expresses the position in the conclusion, it does not draw on the developed argumentation.

2. The range of **argumentation strategies** comprise adversarial strategies, and few or unsuccessfully implemented conciliatory strategies. For example juxtaposing advantages to disadvantages means failing to weigh them out successfully (see Juxt. adv-disadv, in Antony's baseline essay Table 5.18, and Harriet's baseline essay Table 5.19).

3. Argumentation balance: Supporting and countering arguments are balanced, as quantified in argumentation moves. For example, 5 out of 13 are supporting moves and 5 out of 13 are countering (Ann's baseline essay Table 5.16).

4. Argument-position coherence: The unclear position in combination with the continuous alteration of argument moves, which are deployed without being adequately developed, linguistically signified, and clearly associated with other moves confuse the reader regarding the writer's position. Thus, the reader is struggling to infer the writer's position and how each argument move relates to an implied position. Unrefuted counterarguments add to the confusion in some cases (Counter unrefuted in Ann's baseline essay Table 5.16, Harriet's baseline essay Table 5.19, and Sheila's Table 5.17)

5**. Integration strategy issues:** The integration problem in this category is related to items 1 and 4 above. Although counterargument integration strategies are implemented, such as refutation and weighing, this is not reflected in the formulation of the essay position.

5.7.2 Middle Pseudo- integration group: text change

The baseline essays of the 4 participants, Ann, Sheila, Antony and Harriet are characterised by weaknesses in semantic parameters 1, 4 and 5. Interestingly, all except Harriet, progress in the posttest essay in terms of parameters 1, 4 and 5 while all participants improve in terms of parameter 4, argument-position coherence (Table 5.15). The latter means that it is easier for the reader to understand the writer's position and follow the associated argumentation. The position is expressed clearly (Ann and Sheila, Table 5.15, item 1), argument moves are deployed in more depth (Antony, item C) and are better interconnected (Ann and Sheila, item B, juxtaposition eliminated). All counterarguments are refuted (Counter unrefuted = 0 in posttest essays of Sheila Table 5.17, and Harriet Table 5.19).

More specifically, in line with this progress is that the essay position, apart from being clearly expressed in the conclusion, draws on the developed argumentation (Table 5.15, item 5, Ann, Sheila, and Antony). A comparison of the conclusion of the baseline and posttest essays shows the effect. In particular, in the conclusion of the baseline essay, Ann presents briefly her position followed by a supporting but irrelevant to the rest of the essay statement. She excludes counterarguments and does not take into account the developed in the essay arguments. An improvement however is noted in the posttest essay: the conclusion not only integrates the points developed in the essay but also defines the conditions under which developed arguments and counterarguments apply (Synthesis – contingent schema in expressing the position see Table 4.8, p.152). Synthesis is a characteristic of advanced integration levels in general. A similar improvement is seen in Antony's posttest essay, regarding the position in the conclusion of the essay (Table 5.15, item 1 and 5).

In Sheila's case there is no position in the introduction of the baseline essay. The introduction expresses that there are advantages and disadvantages but does not express an inclination to either. Then, the second paragraph presents the advantages of Facebook, and the third paragraph the disadvantages, letting the reader believe that the essay will take a position in favour of the advantages of Facebook. The fourth, the fifth and the sixth paragraph, however do exactly the opposite. Until the essay position is expressed in the conclusion the reader is left wondering and trying to infer the writer's position. In the posttest essay, Sheila presents the position clearly from the introduction of the essay while, in the remainder of the essay, all paragraphs either directly support the position or refute counterarguments.

Another aspect concerning the progress of semantic structure is the range of argumentation strategies. In this group the main strategy in the baseline essay is the refutation strategy

Pseudo-integration middle	Ann (PC)		Sheila (Paper)		Antony (Paper)		Harriet (PC)	
Semantic argumentation parameters in baseline	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
1. Position: unclear despite exploring both sides of debate	√	**PI high**	√	X **PI**	√	X	√	√
2. Range of integration strategies : mainly adversarial strategies, few or unsuccessful conciliatory strategies	√	**PI high**	√	**PI low**	√	√	√	√
3. Argumentation balance: supporting and countering moves are balanced	√	√	√	**PI low**	√	√	√	√
4. Argument–position coherence: difficult to discern writer's position at times	√	X	√	X	√	X	√	X
5. Integration strategy issues: Main body argument integration not reflected in position	√	X	√	X	√	X	√	√
Rhetorical argumentation parameters in baseline	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
A. Rhetorical structure organisation issues: Thematic continuity, argument orientation structure	N/A	N/A	N/A	N/A	√	√	√	√
B. Juxtaposition: paragraphs or arguments juxtaposed without being weighed out	√	X	√	X	√	√	X	√
C. Development of depth: Shallow development of paragraphs or statements, short paragraphs, abrupt switching between argument moves,chains	N/A	N/A	N/A	N/A	√	X	√	√
D. Relevance: Digression/Topic drift, Unrelated statements	√	X	X	√	√	X	X	√
E. Clarity: Unclear statements	N/A	N/A	N/A	N/A	N/A	N/A	X	√
F. Repetition: Can be related to refutation or supporting arguments	N/A	N/A	X	√	N/A	N/A	N/A	N/A

KEY: BASL: baseline, ARG.D.: posttest, √ confirms existence of element, X shows absence of element, green shade: improvement, red shade: deterioration

Table 5.15: Pseudo-integration middle group progress in text

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	26	40%	5	38%	1	Intro	NEUTRAL	1		
CNTR	15	23%	5	38%	1	Support	SUP	1		
REFT	10	15%	1	8%	2	Counter unrefuted	CNTR	1	Unrelated	1
NEUT	6	9%	1	8%		Refutation-weak	CNTR-**REFT**	2	Weak support Weak refutation	1 2
NF	8	12%	1	8%		Concluding	POSITION	1	Drift/digress	1
Total	**65**		**13**		**4**	Total		**6**		
Posttest										
SUP	14	28%	6	33%	1	Intro	NEUTRAL	1		
CNTR	18	36%	7	39%	1	Support	SUP	1		
REFT	13	26%	3	17%	2	Counter unrefuted	CNTR	1		
NF	0	0%	0	0%		Refutation	CNTR-**REFT**	1		
NEUT	5	10%	2	11%		Weigh min.	CNTR-**REFT**	1	Weak support	1
Total	**50**		**18**		**4**	Concluding	POSITION-CONT.	1		
						Total		**6**		

Table 5.16: Baseline and posttest essay of Ann (Middle Pseudo-integration, PC)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	57	44%	4	29%	4	Intro	NEUTRAL	1		
CNTR	36	27%	5	36%	1	Support	SUP	4	Drift-digress	1
REFT	36	27%	4	29%	4	Counter unrefuted	CNTR	1		
NEUT	2	2%	1	7%		Refutation	CNTR-**REFT**	1		
NF	0	0%	0	0%		Weigh min.	CNTR-**REFT**	2		
Total	**131**		**14**		**9**	Problem solution	CNTR-**REFT**	1	Weak solution	1
						Concluding	HINTED POSITION	**1**		
						Total		**11**		
Posttest										
SUP	69	51%	8	42%	4	Intro	POSITION	1		
CNTR	20	15%	5	26%		Support	SUP	4	Repetition	1
REFT	42	31%	5	26%	4	Refutation	CNTR-**REFT**	3	Unrelated	1
NF	4	3%	1	5%		Problem solution	SUP-CNTR-**REFT**	1		
NEUT	0	0%	0	0%		Concluding	POSITION	1		
Total	**135**		**19**		**8**	Total		**10**		

Table 5.17: Baseline and posttest essay of Sheila (Middle Pseudo-integration, Paper)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	44	36%	4	21%	2	Intro	NEUTRAL	1		
CNTR	37	30%	6	32%	1	Support	SUP	2		
REFT	33	27%	8	42%	6	Counterargument	CNTR	1		
NEUT	0	0%	0	0%		Refutation	CNTR-**REFT**	2		
NF	8	7%	1	5%		Refutation-weak	CNTR-**REFT**	3	Weak refute Unrelated	2 2
Total	**122**		**19**		**9**	Juxt adv-disadv.	CNTR-**REFT**	1		
						Concluding	POSITION	1		
						Total		**11**		
Posttest										
SUP	32	31%	5	22%	3	Intro	POSITION	1		
CNTR	40	39%	9	39%	2	Support	SUP	3		
REFT	29	28%	8	35%	5	Counterargument	CNTR	2		
NF	0	0%	0	0%		Refutation	REFT	1		
NEUT	2	2%	1	4%		Refutation-deep	REFT	1		
Total	**103**		**23**		**10**	Weigh min.	CNTR-**REFT**	1		
						Juxt adv-disadv	CNTR-**REFT**	2		
						Concluding	POSITION	1		
						Total		**12**		

Table 5.18: Baseline and posttest essay of Antony (Middle Pseudo-integration, Paper)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	36	39%	8	36%	1	Intro	POSITION	1		
CNTR	23	25%	8	36%	1	Support	SUP	1		
REFT	27	29%	5	23%	5	Counter unrefuted	CNTR	1		
NEUT	0	0%	0	0%		Refutation	SUP-CNTR-**REFT**	1		
NF	6	7%	1	5%		Refutation-deep	CNTR-**REFT**	1		
Total	**92**		**22**			Refutation-weak	SUP-CNTR-**REFT**	2	Weak refute Repetition	2 1
						Problem solution	CNTR-**REFT**	1	Weak solution	1
						Concluding	HINTED POSITION	1		
						Total		**9**		
Posttest										
SUP	59	40%	12	35%	1	Intro	POSITION	1		
CNTR	39	26%	11	32%		Support weak	SUP	1		
REFT	29	19%	9	26%	7	Refutation	SUP-CNTR-**REFT**	1	Unrelated	1
NF	13	9%	1	3%		Refutation-weak	SUP-CNTR-**REFT**	1	Weak refute	1
NEUT	9	6%	1	3%		Juxt adv-disadv.	SUP-CNTR-**REFT**	2		
Total	**149**		**34**			Problem solution	CNTR-**REFT**	3	Weak solution	1
						Irrelevant	NF	1		
						Concluding	HINTED POSITION	1		
						Total		**7**		

Table 5.19: Baseline and posttest essay of Harriet (Middle Pseudo-integration, PC)

(adversary strategy). Sheila applies the weighing minimization strategy (conciliatory) successfully and Antony applies it unsuccessfully (Juxt adv-disadv Table 5.17 Table 5.18). The progress in the posttest essays is noted mainly in enhancing the refutation strategy. This is achieved by reducing weak refutations, and by increasing refutation moves (Ann, Sheila, Harriet). Weak refutations are reduced because there are more relevant refutation statements (Ann, Antony, Harriet), and refutations are better associated to counterarguments (Ann, Sheila, Antony). However, the weighing minimization strategy is eliminated in Sheila's posttest essay (Table 5.17) and emerged in Ann's (Table 5.16) and Antony's essay (Table 5.18).

The least improvement in terms of semantic structure is seen in Harriet's posttest essay, in which unrefuted counterarguments are eliminated, that is progress is noted only in the argument-position coherence (Table 5.15, item 4). No other improvement is noted in terms of semantic structure. Conversely, weaknesses regarding the rhetoric structure parameters emerge (Table 5.15, Harriet, ARG.D column, items B. Juxtaposition and D. Relevance, A). Sentences are often juxtaposed without signifying linguistically the relation between them. Many of the arguments are weakly related to the question of the essay, and a whole paragraph completely digresses from the main question.

5.7.3 Middle Pseudo- integration group: process change

The text analysis showed that there is change in two main aspects. The first involves progress in the argument-position coherence. The second encompasses change in the argumentation strategies, in particular enhancement of refutation strategies (adversarial) and mixed results regarding the weighing minimization strategy (conciliatory). As this group is characterised by

adversarial strategies and fewer conciliatory, progress would entail improvement to a certain extent in both.

Position formulation process

In the baseline essay, Sheila deliberates over her position by referring to arguments and counterarguments, but hesitates to formulate a position and to integrate them in her own position until much later when she composes the conclusion. In the beginning of composing she declares her intention to present advantages and disadvantages, and she is hopeful that the position will somehow emerge.

> |TYPES:|<<I personally use Facebook to speak to friends and family abroad, as well as to speak to people who I am not very close to such as students on my course… >>
> |TRANSCRIPTION NOTE: |/She pauses and then looks at the diagram, but it's not clear what she is reading/
> |<<to find out issues I may have with the lecture notes or seminar times.>
> |SPEAKS:| 'This paragraph's going to be dedicated to positive aspects of Facebook….'
> /She turns to her diagram and draws a vertical line down the right of the page to turn the diagram into a complete table/
> 'Rather that jumble the two together, I prefer to do positive and then do counterarguments afterwards.'
> /While saying this, she draws a vertical line down the left of the page to turn the diagram into a complete table/
> /She turns back to the computer/
> 'I don't just want to have a black or white perspective, I want to show that my thoughts are being adapted as I think, and so I'll mix the two together, so I might do positive, then negative, positive then negative, and it's not until my conclusion, maybe, that I guess they'll see if I do have a particular side which I swing towards'

The reported strategy results into using the writing process as a platform of position deliberation. Later on in the writing process, and while composing the first paragraphs of her essay, she interrupts to construct two spider diagrams (Figure 5.10) in order to represent the advantages and disadvantages on two separate pieces of paper, and contrast the two views 'Facebook should and should not be used to build relationships'. She counts the number of arguments in an effort to define the side she inclines more to. Overall her intention to deliberate over her position is not supported effectively during planning and writing. As

mentioned in the previous section, the argument-position coherence is weak in her essay. Just before composing the concluding paragraph she reflects again on the balance of her argumentation by looking both at the essay and paper-drawn plans in order to define her position. She is still unsure about it. The conclusion draws on some of the supporting arguments and introduces a few new ones.

In the *posttest essay*, Sheila formulated her position while analysing it with the argument diagram. The analysis led her to realise that the position, which she initially explored with the diagram, could not be adequately supported, because there were many unrefuted counterarguments. Despite having to adopt the opposing position, and to mentally invert some of the diagram connections, she is more confident about how to introduce her position in the essay.

> /On starting writing she reflects on introduction and diagram/
> 'Just thinking now whether I'm going to reveal the fact that I oppose this statement '
> /by 'this statement' she means the essay question statement/
> /She looks at the diagram and indicates it with the open palm of her hand showing she refers to the whole of it/
> '…or whether just to leave that for the conclusion. But I think now is a good time because I've got such clear points with this topic, I think it's fine for me to show what I think now and just support it throughout the essay, so that's what I'm going to do.'
> /She returns to the screen and starts typing straight away/
> <<I firmly disagree with. Though I can see some benefits in charging students, I believe that not charging fees far outweighs…>>
> /She stops typing and reads through the sentence so far, and then tarts typing/
> <<…them.>>
> /Pauses; reviews and makes word amendment/
> /She glances at her diagram and then back to the screen/
> 'So that's the start.'
> /Resumes typing/
> << In this essay I shall highlight the reasons why I consider free higher education to be a great support to both students, as well as the positive effects this will have on the economy and society today.>>

Sheila takes extra care to introduce arguments that are consistent with her position throughout the essay. While expanding on them, she makes sure they support her position. It is interesting

to note that while composing the baseline essay the criteria list prompted Sheila to reactively think about her position and about inventing counterarguments and refutations. In the posttest essay, she engages proactively in developing the structure of the diagram, and thus reasons about the position every time she adds a new argument on it. This analytical procedure helps to build confidence in her position.

If we compare the baseline plan (Figure 5.10) with the argument diagram plan (Figure 5.11) we observe that the baseline plan disconnects the representation of the two approaches 'Facebook positive' and 'Facebook negative' into two separate pages. Sheila is using these two plans to explore the balance of positive and negative argument and define the position of her conclusion. However, this type of plan does not make salient associations between the two positions and corresponding arguments. Possible dependencies between the two are hidden. She finally counts the points on each plan in order to decide which side she 'swings' to. The argument diagram (Figure 5.11), in contrast, makes the associations between textboxes salient

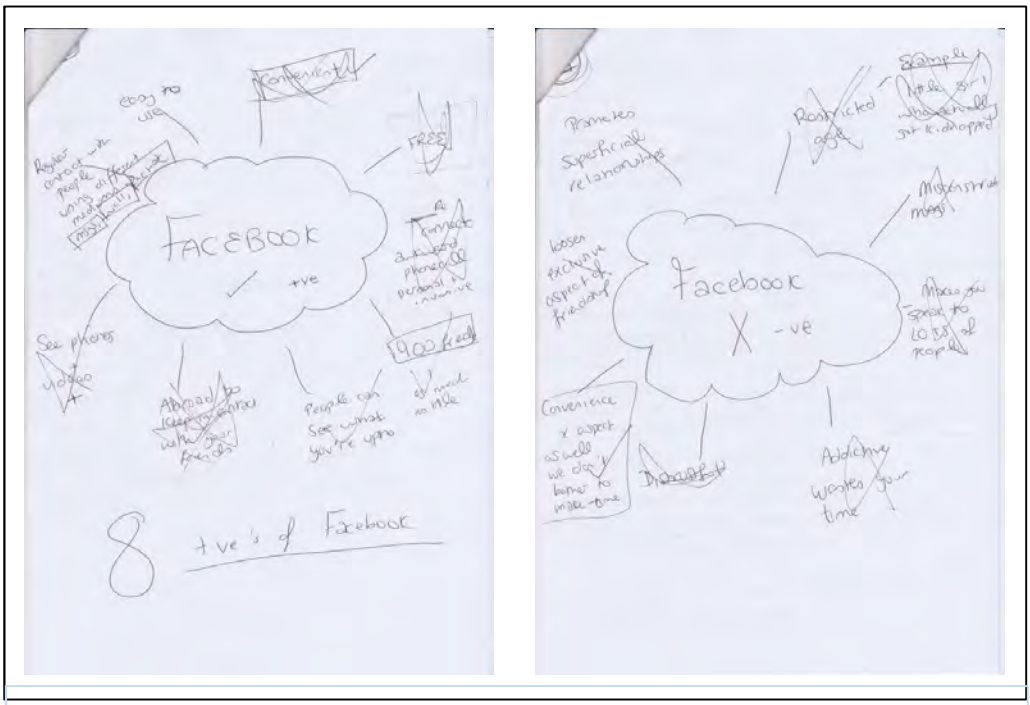


Figure 5.10 Sheila's baseline plan

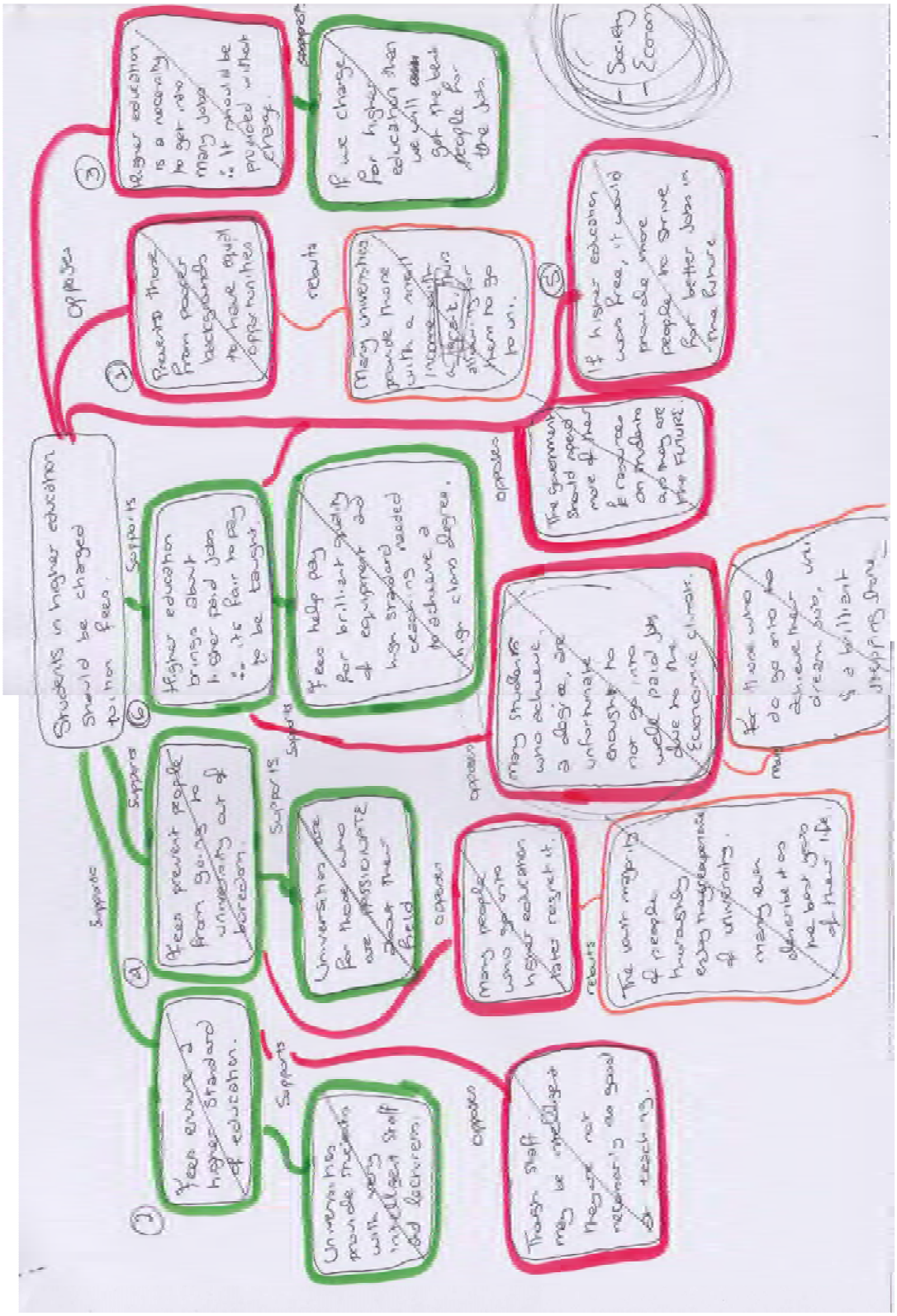


Figure 5.11 Sheila's paper-based argument diagram

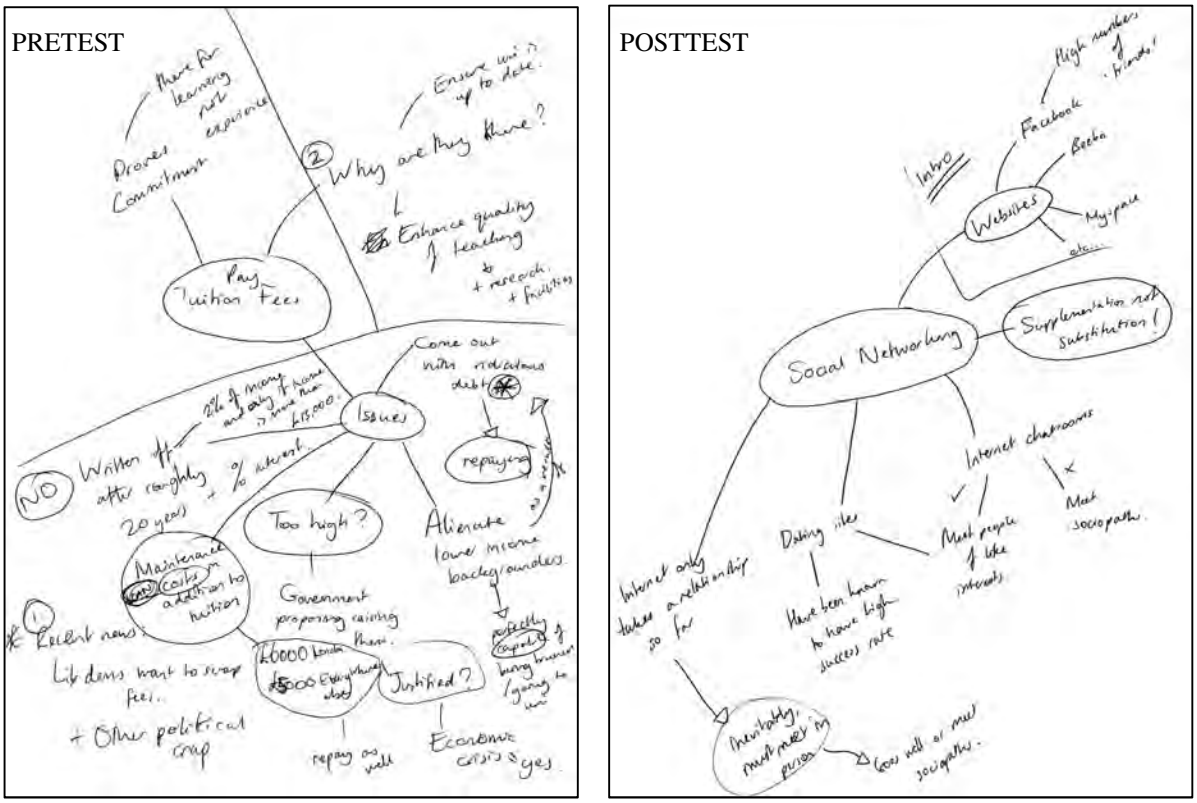


Figure 5.12: Ann's ideas network during baseline essay and posttest essay

and the overview of argument and counterargument balance visible. These properties contribute to understanding the relation between argumentation and position better. This, in its turn, improves the argument-position coherence.

In a similar vein, Ann is also hesitant about her position in the *baseline essay*. She brainstorms for 11 minutes using an ideas network (Figure 5.12, baseline) exploring issues around a central concept. The plan does not have an argument orientation structure, e.g. a list of positive or negative points, but includes a few causal associations. From what she writes on the plan it is possible to infer that she inclines towards one side (that 'fees should be paid') but she resists acknowledging it.

'What else…?'

/She refers to list of criteria./
'What's my position? I like paying tuition fees, I don't think we should be able to go for free. It weeds out the ones that shouldn't be here at all.
/She reads aloud from list of criteria 2, 'Do I provide reasons to support my position?'/
'I don't know my position but my reasons are there.'
****She ticks 1 Supporting Reasons****

In the *posttest essay*, the formulation of position becomes important during planning and writing. Ann plans for 5 minutes on paper before starting to use the computer-based diagram. Similarly to the baseline essay, she draws an ideas network exploring issues around a central concept (Figure 5.12, posttest). By the end of this initial planning she formulates a clear position and acknowledges it.

/She refers back to guide sheet and repeats the question/
'Should people use the internet to build relationships?'
/She looks back at diagram/
'You can build a relationship on it, but you can't. I think you can get the groundwork for a relationship on the internet, but you have to meet somewhere. Yeah, this is quite important.'
/She circles [13]/
/She glances at the guide sheet and says/
'Where do I stand on this debate?'
/and looks back at the diagram. She looks up away from guide sheet and diagram/
'Only use it as a tool not as a… what's the word…?'
/She looks back at diagram/
'You only use the internet as a tool to supplement what you already have, you do not use it as a replacement.'
[15] <Supplementation not substitution!>
'That's my position.'
/She circles [15]/
/She refers back to guide sheet and say/
'Yes I do take a clear stand.'
****She ticks 1 Clear Position****

The position is then, i.e. prior to argument diagramming, a synthesis -contingent, namely the conditions under which the position applies are defined. ('Internet can be used to build relationships by complementing face-to-face communication', and later 'if internet is used to build relations people should be used it with caution, one should be aware of risks').

Ann, then, proceeds with argument diagramming as *analysis of the position* rather than *deliberation* (Figure 5.14, p.245). She reuses and develops further the points of the idea network using the computer-based diagram of the Rationale diagram. As part of the analysis, she reflects on how parts of the diagram trees contribute to her position.

> What else do I know about the internet?'
> /Pauses, thinking/
> /She reads [1] top textbox 'Using the internet to build relationships' (see Figure 5.14) /
> 'Not good because of that [tree starting at 8 &9] but good because of that [tree starting at 12].'
> /She glances back at diagram and then back to computer/

When she reviews the computer-based diagram in the end of her planning (Figure 5.14), she observes that the diagram contention statement ('Using the internet to build relationships' top textbox of diagram), does not fit her synthesis position ('Internet can be used to build relationships by complementing face-to-face communication').

> 'Ok, I'm happy with this diagram. I can't think of anymore. Maybe I can.'
> /She looks back over diagram/
> 'What have I written?'
> /She turns back to computer screen and reads [1]/
> 'My point of view doesn't really fit under this diagram, 'cause it's not a strongly support or objection. That doesn't help.'
> /She turns to guide sheet and starts to read the question again, before turning back to the computer and saying/
> 'Let's start writing this essay.'

The argument diagram includes two unrefuted counterarguments but also many refutations. Remarkably, Ann's complaint shows that she realises the limitation of the argument diagram notation to represent her synthesis contingent position in the top textbox, the contention statement (Figure 5.14). Her observation is related to a role expressiveness issue. Ann's diagram includes unrefuted counterarguments. She has also used the evaluation function to assign a 'strong' value to some textboxes. These communicate her intention to take a

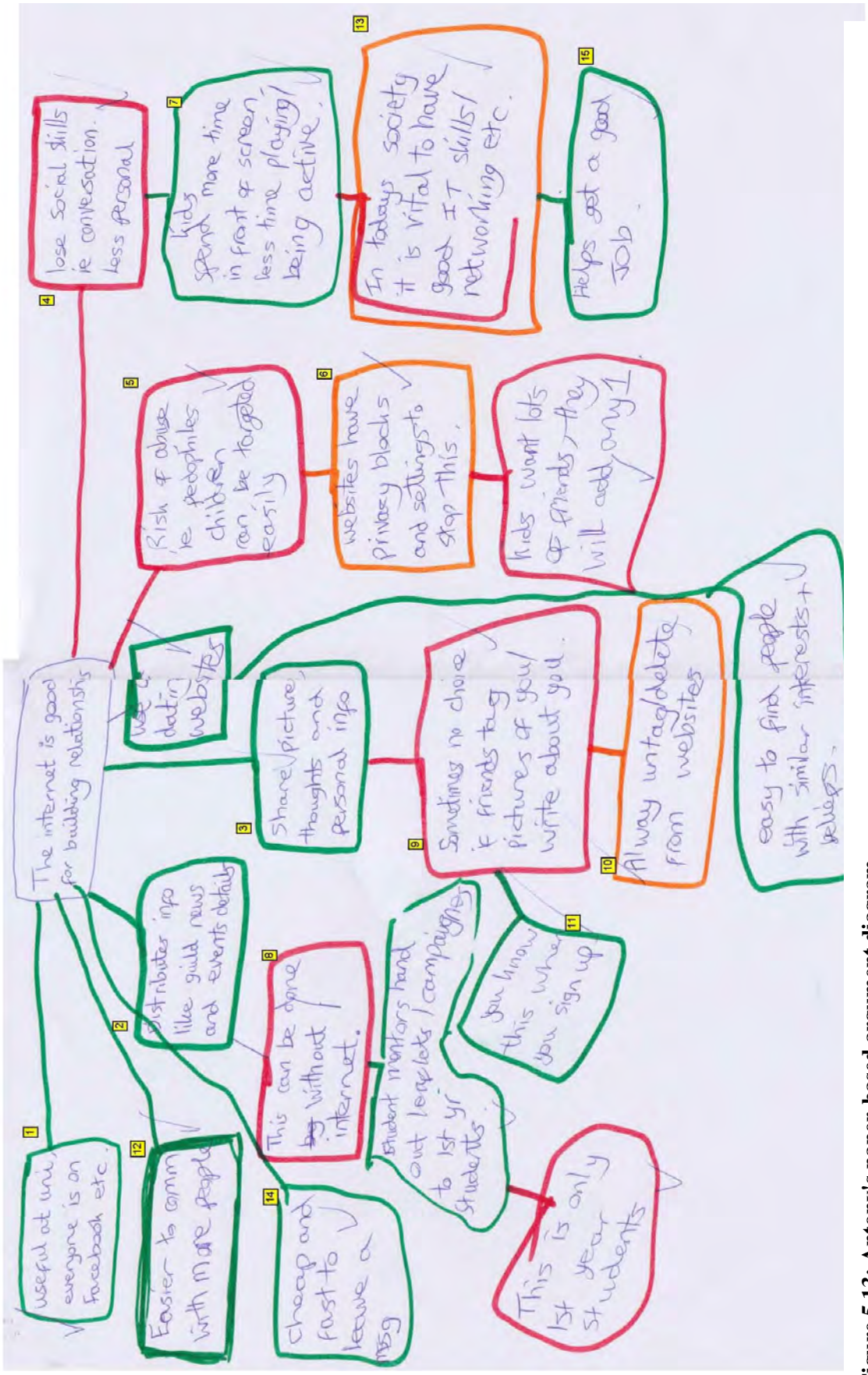


Figure 5.13: Antony's paper-based argument diagram

moderate position, i.e. a synthesis contingent position. Nevertheless, as it will be shown in the following section, Ann overcomes this limitation. She proceeds with revising her position, mentally inverting part of the diagram trees, and synthesising the opposing trees and textboxes in one position in the conclusion. As a result, the coherence between the conclusion and the essay improves.

Finally, Antony's formulation of position in the conclusion is improved if compared with the baseline essay. In the posttest essay, the conclusion draws on the diagram content (Figure 5.13). The paper-based diagram is well laid out, allowing a good overview of the orientation of argument moves. During linearization, Antony relies closely on the diagram for organising the paragraphs. The conclusion integrates most of the counterarguments, and expresses the position in terms of the weighing strategy.

> *In conclusion I think that the advantages of the internet far outweigh the disadvantages. The internet is useful in distributing information, making friends and finding people of similar personalities. Companies can do business and network much easier and organizations like the Guild can cheaply advertise events and news. There is a risk of personal information being available to undesirable people; however privacy block exist to try and combat this. It is also argued that conversational and linguistic skills are suffering because of the decreased amount of time spent in personal contact. But we have also seen that this is important in today's modern environment and in the workplace (Antony, posttest essay, concluding paragraph).*

Antony reviewed the essay and the diagram before writing the conclusion. Continuous interaction with the diagram provided a good overview of the developed argumentation. This led him to a concluding paragraph that is grounded on the main themes and structure of the argument diagram. It can be argued that after composing the essay, the diagram becomes a

point of reference, where the structure of the essay are easily visible and the main points stand out. This contributes to developing a consistent to the essay concluding paragraph.

Deployment of argumentation strategies

In this group the change regarding argumentation strategies pertains to the enhancement of refutation strategy, while there are mixed results regarding the conciliatory strategies.

In Ann's posttest essay, there is i) increase in argument moves and EDU's that are coded as refutation, ii) elimination of weak refutation and unrefuted counterarguments, and iii) use of weighing minimization (Table 5.16). Despite having to change the position by the end of argument diagramming, Ann rephrases and mentally reorganizes the diagram in order to support her new position. In previous cases, in Harry's case, changing the tentative position of the paper-based argument diagram before starting writing has also led to a complex linearization task (see section Myside Bias group: process change p. 195). However, Harry managed to focus on the new task, and develop refutation moves more in depth. A similar observation is made for Ann as well. She mentally inverted the orientation of the arguments that were directly connected to the position. Figure 5.14 shows Ann's actual diagram. Figure 5.17 projects how Ann mentally changed it and organise it in paragraphs, based on the analysis of the essay. Thus the arguments directly countering the position in Figure 5.14, i.e. 6, 8 and 9, in Figure 5.17 support the position, and vice versa for argument 12. The following transcript extract shows her being perplexed over the inverting task.

> 'What am I thinking?'
> /She brings the computer diagram to the front and reviews the right side of the screen ([C12, 13, 14, 15 and 16] whilst saying/
> I'm thinking that Facebook is…. Maybe I might have to do this backwards?'
> /She reads [C12, 13, 14, 15 and 16] and says,
> 'Yeah, I'm going to have to do this backwards.'/
> /She continues reviewing [C12, 13, 14, 15 and 16] and says,/
> 'Oh, this diagram isn't very good. Well it is, but it isn't'

/She returns briefly to the essay before flicking back to the computer diagram, saying/,
'Too rigid,'
/and then returning to the essay/

This is the second time that Ann shows disappointed about the function of the diagram and software. This time Ann refers to the viscosity of the system and diagram to adapt to the revised position and inverting of argument orientation. She does not restructure, similarly to Harry, the diagram. However she works, more vigorously than Harry, with the diagram, making the most of the existing content.

Figure 5.17 represents also the relation between textboxes and individual paragraphs and the argumentation strategy in each one. The blue outline defines paragraph #3, which is translated in a weighing minimization strategy.

> *Despite these cases against internet interaction, there are many cases where the internet has been at the heart of strong interpersonal relationships. Forums and fan sites allow people of like interests to meet and discuss topics about which they are passionate. Such discussion can lead to the building of strong foundations for friendships that last for life, the best example of which is those people who have built marriages from burgeoning internet interaction. Dating sites often have a high success rate with long-lasting relationships which can lead either to simple friendship or at its best, lifelong partnership and marriage. However, these relationships are restricted using only the internet; inevitably, the further steps to deepen any relationship require meeting in person (Ann, posttest essay, paragraph #3)*

In paragraph #3, the diagram content of textboxes 2, 3, 4 and 5 (Figure 5.17), after being rephrased and elaborated, is introduced as a series of countering moves, or advantages of Facebook, which are minimized in the latter part of the paragraph covering textboxes 11 and 12.

Interestingly, Ann leaves out the rebuttal included in textbox 20. The reason for this is related to the use of the evaluation function of the Rationale software. (The evaluation function was demonstrated to participants as a tool for assigning strength to the textboxes in accordance with the explanation on the software tooltip. For example, strong value is assigned to a countering textbox if it is considered to provide strong grounds for countering the reason above it. Evaluation strength can be interpreted as relevance or importance but was not specifically instructed as either. On the diagram, as in Figure 5.17, the strong value is shown with two dots. The participant used only the strong value, while weak and nil values are also possible to assign). She used the strong evaluation as a process for confirming the relevance and consistency of textboxes with the position. The refutation textbox 20 is not evaluated at all as opposed to the other textboxes of the same tree. Similarly, the sub trees that are included in the text (see sub trees #2, #3, #4 and #5 on Figure 5.17) are also assigned a high evaluation value. In fact, after retracting the tentative position, Ann tried to move textbox 20, and to insert it between textboxes 2 and 3, which would have been semantically correct, but she did not succeed to manipulate it on the screen and left it at the same position. As a solution she excluded textbox 20 from the text. As shown on Figure 5.17, the structure of sub tree #4 is consistent with the argumentation strategy of the corresponding paragraph. The last paragraph before the conclusion, the translation of sub tree #5, is coded as an unrefuted counterargument in the text, which is consistent with the argument diagram tree. As seen previously, a diagram structure that includes an unrefuted counterargument can be translated into a weighing strategy. However, in this case, it did not. Neither had Ann tried to refute it in the text as seen with other participants. Thus the last paragraph before the conclusion, paragraph #5 presents a counterargument which is not integrated. However, as the conclusion includes a synthesis position it does not contradict the position nor confuses the reader. Overall the diagram

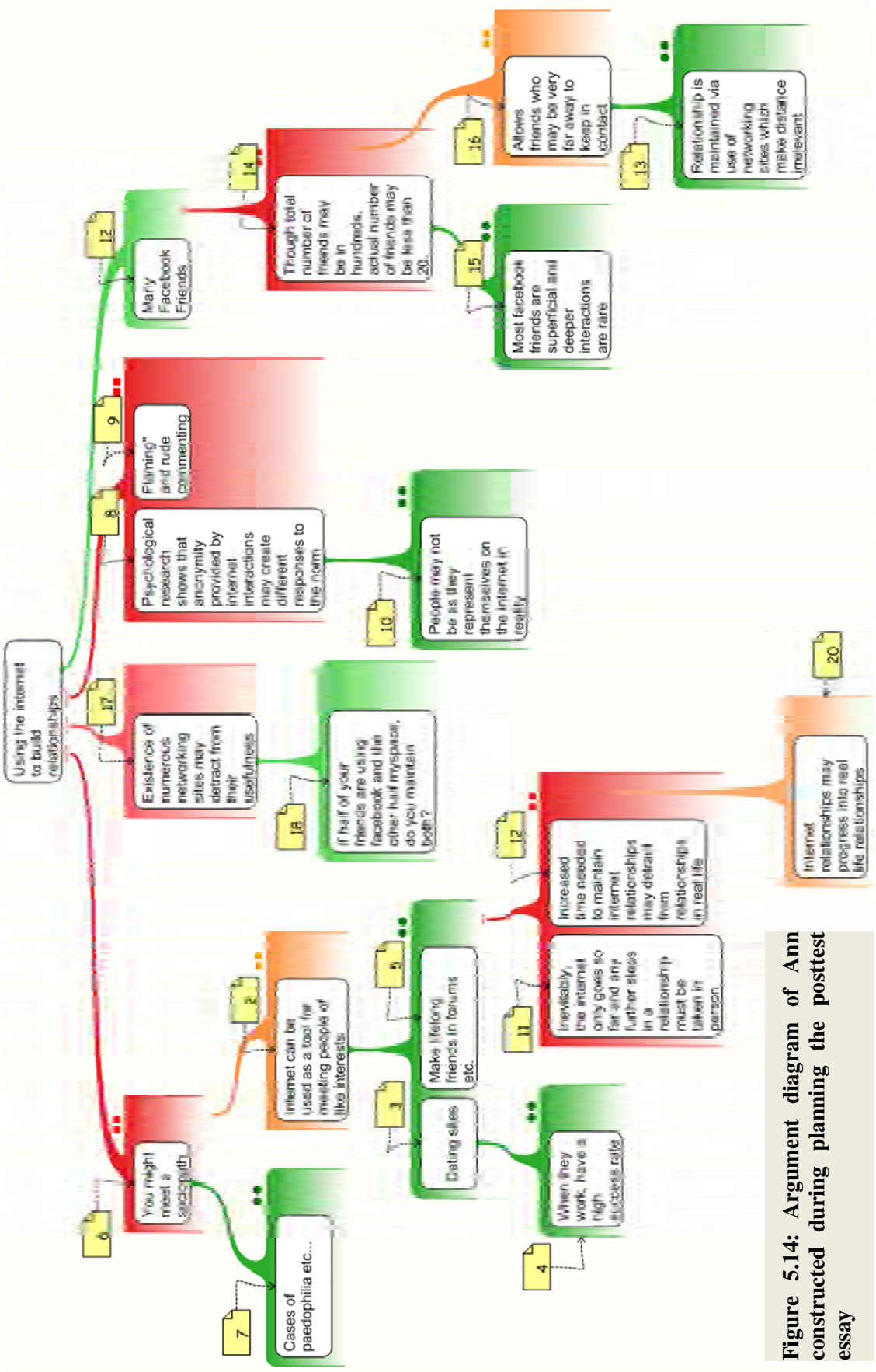


Figure 5.14: Argument diagram of Ann constructed during planning the posttest essay

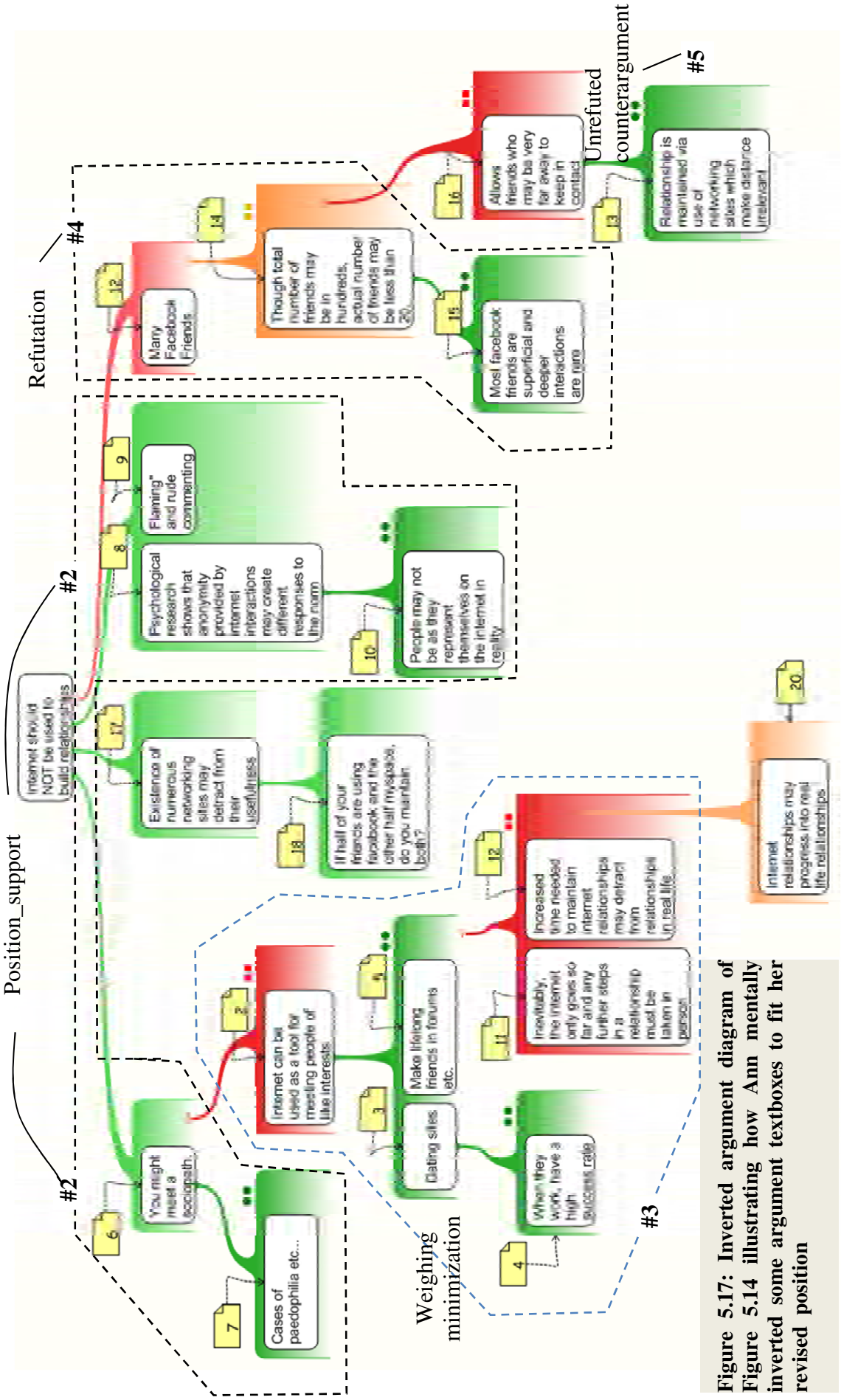


Figure 5.17: Inverted argument diagram of Figure 5.14 illustrating how Ann mentally inverted some argument textboxes to fit her revised position

appears to define effectively the argumentation strategies in Ann's essay and enhanced both the refutation and the weighing minimization strategy. Interacting with the diagram through the use of evaluation function enhanced the linearizing process by making the relevant content salient.

In the case of Sheila, there is a smaller increase of refutation moves and EDUs, but there is elimination of unrefuted counterarguments. There is also elimination of the weighing minimization strategy and increase of unrelated statements (Table 5.17). In the baseline essay, Sheila reactively generated refutation, reflecting constantly on comparing the two sides of the debate through her two column lists and spider diagrams, as described earlier. This explains the inclusion of the weighing strategy. However, as already discussed her intention to reflect and decide her position is not supported during planning or translating. In the posttest essay, after exploring the tentative position of the paper-based argument diagram (Figure 5.14), she decides, as in the case of Ann, to change the position. On Sheila's paper-based diagram is not as easy to read or overview the argument balance. Observation of the argument diagram (Figure 5.14) shows that there are three unrefuted counterarguments, while three other are refuted. It is difficult to infer why Sheila decided to retract the tentative position of the diagram. Integration of unrefuted counterarguments with a weighing strategy would perhaps be possible. However, as Sheila decided to change her position, she faces the complex task, similarity to Ann to mentally invert the orientation of some textboxes, and reorganize the diagram in order to fit the new position. Differently to Ann though, the translation process does not follow a clear rationale, thematic or other. The writer looks mentally for links amongst the diagram textboxes, in order to reuse them in the re-organised text structure. The linearization process follows loosely the structure of the diagram. Only in one or two occasions does she parse the argument chains as they appear in the diagram. Instead, she

relies on some of the points of the diagram and evolves or invents new arguments. As result of awkwardly establishing links across unrelated diagram boxes the text suffers from unclear semantic connections, i.e. unrelated refutations or irrelevant conclusions.

In Antony's posttest essay there is elimination of unrefuted counterarguments, increase of counter arguing moves, and as far as conciliatory strategies are concerned, juxtaposing is replaced with weighing (Table 5.18). Contrary to Sheila, in Antony's essay, relevance and development in depth are improved considerably (see lack of unrelated statements in Table 5.18). This progress is related to improvement of translation and linearization strategy. In the baseline essay the participant reactively develops argumentation in the text, driven by the criteria list, forcing himself to think about counterarguments and refutation. He jumps from one paragraph to another, constantly worrying whether further content is necessary, but fails to develop the added arguments in depth. It is after writing his conclusion and while he is revising the essay that the participant refutes most of the counterarguments, which result to short refuting statements or unrelated statements. In the posttest essay, countering and refuting moves are planned on the diagram and the linearization strategy is supported by the diagram. The participant translates in the essay entire argument chains of the diagram, from top (Level 1 directly connected to main assertion) to bottom. He often interleaves writing with planning in order to add to the diagram relevant content. He focuses on one argument chain or textbox group at a time, rather than jumping from one paragraph to another worrying over adequacy of content. By drawing on the content of the textboxes and developing them further in the text (development in depth) he improves the flow between counterarguments and refutations and eliminates unrelated statements. After completing each paragraph the participant observes the diagram in order to plan the following paragraph.

Process of baseline essay		
	Ann	**Sheila**
1. Type of plan	a) Content plan -ideas network	a) Two list column 'for' and 'against', b) two spider diagrams for each side
2. Planning duration	11 min of total 1h 30 min	a) 5 min b) 14 min of total 2hours
3. Plan entries	24	a) 17 b) 24 of which some already in a)
4. Ideas/argument generation	Themes around central concept, no argument orientation, some links between concepts	3-page plan: a) 'for' and 'against' points list b) analysis of each side, comparing number of points
5. Essay position	Reflects on but not sure about position during diagramming. It is defined in conclusion	Reflected upon while planning and composing but defined in conclusion
6. Criteria list	Reactively engaging in argumentation	Reactively, list item prompts refutation
7. Reflection on planning	Prompts herself to think of new ideas and to relate to essay question. Plan is criticised for being messy and limited in evidence.	Concerned over balance of 'for' and 'against' but difficult to define position, hence resumes planning
8. Plan to text linearization	Plan as content reminder. Further composing goals while reviewing text	Planning used to support deliberation over position, but not very effectively
9. Rhetorical plan	No rhetorical plan	No rhetorical plan
10. Interleaving	No	Yes, 18 minutes in task commences b)
11. Revision	Constantly revising paragraphs and setting goals for following paragraphs	Reviews and sometimes revises previous bits to connect with current
Process of posttest essay		
1. Type of plan	Content plan, paper-based, then computer-based diagram	Paper-based
2. Planning duration	a) Content plan 5 minutes b)computer-based 20 minutes of total 1h 20 mins	a) 25 minutes of total 1h 40 minutes
3. Plan entries	20, 1 support (!),12 counter, 7 refutation, 4 trees, 4 max level	b) 18, 6 support, 7 counter, 4 refutation, 5 trees, 3 max level
4. Diagram content generation	Mainly developing each tree from top to bottom, few additions between branches.	Switches between sub trees, then develops lower levels (Zigzag)
5. Essay position	On completion of content plan (synthesis). Diagram analyses position	On completion of diagram planning. Adopts opposing to tentative position
6. Criteria list	Proactively engaging in argumentation	Proactively engaging in argumentation
7. Reflection on diagram	Observes that the synthesis position (defined by content plan) is not represented with the argument diagram	Reflection on essay position, balance arguments of differ colour, ordering of themes and paragraphs.
Semantic connectivity of diagram	Good connectivity, good use of notation. But started with contention that differs from content plan position.	Minor issues, such as use of wrong colour once, and unclear association once. Overall acceptable connections.
8. Diagram to text linearization	Diagram inverted. Content reworded and restructured. Extended reflection on ordering of paragraphs.	Diagram inverted. Linearization follows loosely diagram. Mentally redrawn associations, new points in text
9.Rhetorical plan	No rhetorical plan	No rhetorical plan
10. Interleaving	Once to make a note on content plan	Once, writes note outside diagram
11. Revision	Less revising of written text, new goals emerge from reviewing diagram.	Similar revising pattern as in baseline, focusing more on macrostructure now

Table 5.20: Process measures for Ann (PC) and Sheila (Paper) from the Middle Pseudo-Integration group

Process of baseline essay		
	Antony	**Harriet**
1. Type of plan	Brainstorm list, random enumeration of points, no argument orientation	a) Two list column 'for' and 'against', b) Rhetorical plan
2. Planning duration	5 minutes of 1 h 27 minutes	a) 3 min b) 2 min of total 1h34
3. Plan entries	16	13
4. Ideas/argument generation	Brainstorming, noting down ideas as they come to his mind. Limited effort in thinking of argument orientation	a) limited counter and refutation, b) linearizes and prioritizes paragraph themes
5. Essay position	Position taken in the beginning of planning with confidence	Position defined by the end of a)
6. Criteria list	Reactive during planning and writing	Reactive. Confirming in the end only
7. Reflection on planning	Concerned about position formulation and balance of argumentation. Reports unfamiliarity about 'refutation' schema	Concerned about argument orientation. Spoken out ideas poorly recorded in plan
8. Plan to text linearization	Alteration between views. Switching erratically between paragraphs, incorporating list points and new ones	Writing follows closely the rhetorical and content plan. Highly depended on content plan for developing ideas
9. Rhetorical plan	No rhetorical plan	Designed with reference to content plan, identifies paragraph themes, refutation
10. Interleaving	No	Once, adds comment on rhetorical plan
11. Revision	Preoccupied with paragraph level structure and overall structure	Preoccupied with wording, and paragraph level structure
Process of posttest essay		
1. Type of plan	Paper-based	Computer-based diagram
2. Planning duration	17 minutes of total 1h and 15 minutes	58 minutes of total 1h 58 minutes
3. Plan entries	19, 5 support, 8 counter, 6 refutation 4 trees, maximum 4 level	48, 21 support, 18 counter, 9 refutation, 8 trees 4 max level
4. Diagram content generation	Switches between sub trees, then develops lower levels (Zigzag). Playing devil's advocate	By argument orientation (First supporting textboxes, then opposing, then refuting)
5. Essay position	Position taken in the beginning of planning with confidence	Position is decided at beginning of diagram based on prior beliefs.
6. Criteria list	Proactive. Just confirming. Clear argumentation difficult.	Reactive. Confirming in the end only
7. Reflection on diagram	Arguments of different orientation are localised on diagram (e.g. left for support)	Makes sure all counter-arguments are refuted. Less TA. All spoken out ideas captured on diagram
Semantic connectivity of diagram	Good connectivity, good use of notation	Good within textboxes branches. But relevance with main position is weak.
8. Diagram to text linearization	Extended reflection on diagram to organise paragraphs. Expanding considerably on diagram content	No reordering or rearranging takes place before writing. Text from group branches pasted verbatim, little editing.
9.Rhetorical plan	No rhetorical plan	No rhetorical plan
10. Interleaving	Yes, to add to the diagram three times	No, only for coping and pasting
11. Revision	Local revising while composing	Very little revising. Tired from planning process.

Table 5.21: Process measures for Antony (Paper) and Harriet (PC) form the Middle Pseudo-Integration group

In Harriet's posttest essay the number of refutation moves increases but the percentage of EDU decreases, indicating that the refutation moves are not adequately developed (Table 5.19). Furthermore, the supporting arguments and counterarguments are juxtaposed rather than compared and weighed out. During the planning of the posttest essay, Harriet develops the computer-based diagram both in breadth and in depth, taking significantly longer time than in the baseline essay to generate a large diagram (see Table 5.19 for details).

While she takes care of establishing good links between the textboxes, the relation of each sub tree with the essay position (top textbox) is overlooked. The two less relevant sub trees were invented following a train of thought from another tree, ignoring the top level statement. While the occurrence of irrelevant statements is due to this, the weaknesses regarding development in depth and weak refutation is due to the poor linearization strategy. Harriet simply pasted the content of the diagram, using the function of the automatic outline (see Figure 6.3, p.353 for an illustration). Sometimes she inserts a few words or connectives, signalling the argument move (e.g. 'in opposition to this'…) but most of the sentences of the textboxes are simply juxtaposed, following the order of the automatic outline. Furthermore, most of the diagram content is included exactly as it appears in the textboxes without being rephrased.

5.7.4 Concluding remarks for the Middle Pseudo-integration group

Constructing and reflecting on the diagram impacts position formulating

This group have used argument diagramming to enhance the process of formulating a position. According to the evidence reviewed in this study, it seems that the main pre-occupation of this group is how to form a position for the essay that is more sophisticated (in the sense that they allow more nuances) and more in line with the main body of analysis in the essay (Table 5.22). Two strategies were observed at least for the former objective. One of the

writers used argument diagramming to deliberate and formulate a clear position during planning (away from the practice of hinted or unclear positions formed during writing as observed in baseline). Another writer used the argument diagramming towards an opposite objective: she used the argument diagramming to analyse a position she had already decided to take. Here again this takes place during planning. Her aim is to form a concluding position that is composite and has conditions attached (synthesis contingent - the most advanced integration strategy), improved from the 'simple' position she developed in the baseline. Argument diagramming was also used as a control mechanism to check whether the newly invented arguments fit with the adopted position (for the essay) and the developed arguments.

In these cases the visibility of argument orientation and textbox links, as well as the role expressiveness of diagram tree formation support effective practices in deliberation and position analysis. However, the role expressiveness of the argument diagram is limited when more sophisticated positions, such as the synthesis contingent are formulated

Interacting with salient elements of the argument diagram affects the deployment of argumentation strategies.

Salient elements of the diagram, such as counterarguments standing out in red, prompts the participants to check that all counterarguments are refuted. However, this has some implications. First, it is mainly the refutation strategy, and not the weighing or other conciliatory strategies that is enhanced. Second, the existence of unrefuted counterarguments on the diagram prompted the participants in two of the 4 cases (Ann and Sheila) to think that their position is not defended well, and they had to engage in complex linearization tasks. Changing the diagram position destroys the sematic connections between the different arguments. Retracting mentally the position was not accompanied by changing the diagram

itself. The software interface does not afford an easy way of inverting the diagram, and the paper medium is even more viscous to change.

Successful combination of the diagramming and linearizing processes is necessary for improvement.

In terms of rhetorical gains (Table 5.22), argument diagramming is used in similar ways as in the last group, namely as a tool to impose structure to the erratic linearization process. This enables the writer to replace some of the juxtaposition (probably an unsuccessful weighing attempt) with a proper weighing strategy. Argument diagramming, and more specifically the evaluation functionality of its software version, was also used to check out the relevance of added arguments. Antony's careful linearization contributed to improving coherence, development in depth and relevance.

The computer-based diagram is more effective when the visualisation of complex structure is required however it is as viscous as the paper in accommodating change of structure

Both Ann and Sheila decided to retract the position of the diagram after exploring it. Both participants also attended meticulously the linearization process. However, in the case of computer-supported diagram the linearization process was more effective, at least in supporting the participant in reusing the existing diagram textboxes. This supports that the computer-based diagram is better in terms of visibility and role expressiveness tree structures.

Ann dealt effectively with the demands of the complex linearization task. She successfully reorganised the computer-based diagram to fit the new position. On the other hand, Sheila followed loosely her paper-based diagram during linearization. She also mentally redrew some of the semantic links, however, issues such as repetition and unrelated statements emerge in the posttest essay (Table 5.17). It is possible that the untidy visualisation of

Semantic changes	Associated Processes		ArgD
Develop clear position for the essay, moving away from hinted or unclear positions	Formulating position while planning, rather than formulating position while writing (observed in the baseline essay)	PL	PC & Paper
Higher coherence between arguments and essay position	The writer uses her own plan to develop a clear position and then uses the argument diagramming to develop arguments coherent with the position	PL	PC
	Argument diagramming is used to check if new arguments fit with the adopted position of the essay	INTER	Paper
	The essay and the argument diagram are reviewed before writing the conclusions of the essay	WR	Paper
Emergence of sophisticated integration strategies (synthesis contingent integration) in conclusion	Argument diagramming is used for the analysis of the position (rather than deliberation on the position), allowing the writer to develop an overview of arguments with different orientation	PL	PC
	Argument diagramming cannot represent a synthesis position and the writer get disappointed ("the tool is too rigid")	PL	PC
Unclear semantic connections, unrelated refutations and irrelevant conclusions	Once the argument diagramming plan is completed, the writer decides to invert the position, using some points of the diagram to develop new arguments – the linearization process follows loosely the structure of the diagram, the sematic connections created during planning are destroyed	LN	Paper
Rhetorical changes	**Associated Processes**		**ArgD**
Juxtaposition is replaced with weighing strategies	The argument diagramming prompts a more structured approach to planning and translation, encouraging appropriate linearization. Argument diagramming is used to develop the countering and refuting arguments within a chain and then entire argument chains from top to bottom are translated into the essay – one at a time. Shift from baseline erratic linearization	PL LN	Paper
More juxtaposition	Poor linearization process caused by the use of the automatic function of the software to linearize diagram to text, with the writer adding a few connectives	LN	PC
Improve relevance of content	The evaluation functionality of the tool is used to classify textboxes and sub trees as strong, weak or nil value	PL	PC
	The writer interleaves between writing and planning and he uses argument diagramming in this process to check the relevance of the added content/arguments.	INTER	Paper
Digression and less clarity	Sub trees are invented following a train of thought from another sub tree, resulting in unrelated statements and losing the connection with the essay position (top textbox)	PL	Paper

PL = Planning, LN = Linearization, Inter = Interleaving, WR = Writing

Green cells = improvement compared to baseline; Red cells = deterioration compared to baseline

Table 5.22: Text changes and associated processes in posttest essay in the Middle Pseudo-integration group

argument structure on paper limited Sheila in redrawing links mentally and organise textbox groups in paragraphs. Inverting and mentally tracing the association between argument boxes is bound to be more difficult to visualise on the paper diagram. On the other hand, although it would have been easier for Ann on computer she does not proceed with this.

The software tool did not work that well when it was employed for a more complex job, namely the automatic linearization function. In Harriet's case planning with the computer-based diagram was extended and productive. However, as it was combined with a poor linearization strategy, the final result is an essay with more juxtaposition than in the baseline essay.

5.8 High Pseudo integration group

5.8.1 High Pseudo-integration group: baseline text

Fern, Shaun, Fiona and Diane are considered in the pseudo-integration high group. The main characteristic of this group at baseline is that the participants combine more often the conciliatory and adversary strategies in their essays. They also express a clear position in the introduction or conclusion of the essay. In particular the baseline essays are characterised by the following:

1. The **essay position** is clear and sometimes is expressed with a qualification and sometimes with a synthesis-contingent approach. For example, in Shaun's conclusion, the condition under which the position is acceptable is defined (position qualification):

> *In conclusion, social networking sites have their advantages and disadvantages. In response to the question of whether people should use the internet to build relationships, I believe that social networking sites are a valuable tool that, if used correctly, can be extremely beneficial to the user. People should definitely not replace real relations hips with virtual relationships, but instead use the internet*

> *to continue already established relationships, if interaction is reality is difficult, and also use it to begin new relationships that one may continue in reality. If social networking sites are used in moderation, they can be a useful tool for the user, and that is the key, for the user to use social networking sites for their own benefits, whilst being aware not to become used by the site itself (Shaun, baseline essay).*

2. The **range of argumentation strategies** includes both adversary and conciliatory strategies with more emphasis on the latter. However both strategies are applied with problems.

3. In terms of **argument balance** it is observed that usually the supporting moves are roughly equal to the sum of countering and refuting moves.

4. **Argument-position coherence**: The developed argumentation and the position of the essay are in agreement.

5. **Integration issues**: The main problem that complicates the integration of arguments and counterarguments in this category is the existence of weak refutation. This is due to repeating supporting statements as refuting, and to unclear or undeveloped refuting statements.

5.8.2 High Pseudo-integration group: text change

An important characteristic of the 4 participants in their baseline essay is that, first, they tend to employ both conciliatory and adversary strategies (see Table 5.24 to Table 5.27). As far as change of semantic structure is concerned, two important changes take place. First, refutation increases and, second, the range of argumentation strategies narrows down to refutation strategies. The conciliatory strategies are either eliminated from the posttest essays (Fern-Table 5.24, Shaun-Table 5.25, Diane- Table 5.27), or applied with problems (Fiona, -Table 5.26). The increase in refutation is seen in both EDUs and refuting argument moves in all participants. Fern, Fiona, and Diane increase the refutation in depth as well. The posttest.

Pseudo-integration high	Fern (PC)		Shaun (PC)		Fiona (Paper)		Diane (Paper)	
Semantic argument. structure	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
1. Position: clear position, sometimes with qualification, sometimes synth. contingent	√	√	√	X	√	√	√	√
2. Range of integration strategies: adversarial and conciliatory strategies	√	X	√	X	√	X	√	X
3. Argumentation balance: supporting and countering moves are balanced	√	√	√	√	√	√	√	√
4. Argument–position coherence: argumentation reflects the writer's position	√	√	√	√	√	√	√	√
5. Integration strategy issues: Refutation strategy applied with problems	X	√	√	√	X	√	X	√
Rhetorical structure	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
A. Rhetorical structure organisation issues: Thematic structure, argument orientation structure.	X	√	N/A	N/A	N/A	N/A	√	√
B. Juxtaposition: paragraphs or arguments juxtaposed without being weighed out	N/A	N/A	√	X	√	√	√	√
C. Development of depth: Shallow development of paragraphs or statements, short paragraphs, abrupt switching between argument moves and **chains.**	X	√	√	X	X	√	X	√
D. Relevance: Digression/Topic drift, Unrelated statements	X	√	√	X	N/A	N/A	√	√
E. Clarity: Unclear statements	X	√	N/A	N/A	√	X	X	√
F. Repetition: (Can be related to refutation or supporting arguments.	X	√	X	√	√	√		

KEY: BASL: baseline, ARG.D.: posttest, √ confirms existence of element, X shows absence of element, green shade: improvement, red shade: deterioration

Table 5.23: High Pseudo-integration group progress in text

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	50	55%	11	42%	3	Intro	POSITION	1		
CNTR	25	27%	9	35%		Support	SUP	2	Repetition	1
REFT	13	14%	5	19%	3	Refutation	CNTR-**REFT**	1	Repetition	1
NEUT	0	0%	0	0%		Refutation-weak	CNTR-**REFT**	1	Unrelated	1
NF	3	3%	1	4%		Weighing min.	CNTR-**REFT**	1		
Total	**91**		**26**		**6**	Synth. contingent	**SUP**-CNTR	1		
						Concluding	POSITION	1		
						Total		**8**		
Posttest										
SUP	43	40%	12	41%	2	Intro	POSITION			
CNTR	24	22%	7	24%		Support	SUP	2		
REFT	37	35%	9	31%	4	Refutation	SUP-CNTR-**REFT**	1		
NF	0	0%	0	0%		Refutation-deep	CNTR-**REFT**	3		
NEUT	3	3%	1	3%		Concluding	POSITION			
Total	**107**		**29**		**6**	Total		**6**		

Table 5.24: Baseline and posttest essay of Fern (High Pseudo-integration, PC)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	53	43%	7	41%	3	Intro	NEUTRAL	1		
CNTR	32	26%	3	18%		Support	SUP	3	Weak support Repetition	1 2
REFT	19	15%	4	24%	4	Refutation-weak	CNTR-**REFT**	1	Weak refutation	1
NEUT	0	0%	0	0%		Refutation-deep	SUP-CNTR-**REFT**	1		
NF	20	16%	3	18%		Weighing min.	CNTR-**REFT**	1	Weak support	1
Total	**124**		**17**		**7**	Weighing	CNTR-**REFT**	1	Repetition	1
						Concluding	POSITION-QUAL.	1		
						Total		**9**		
Posttest										
SUP	18	21%	8	36%	0	Intro		0		
CNTR	29	34%	7	32%		Refutation	SUP-CNTR-**REFT**	2		
REFT	35	41%	6	27%	3	Refutation-weak	SUP-CNTR-**REFT**	1	Drift/digress	1
NF	4	5%	1	5%		Concluding	POSITION	2	Weak refutation	1
NEUT	0	0%	0	0%						
Total	**56**		**22**		**3**	Total		**5**		

Table 5.25: Baseline and posttest essay of Shaun (High Pseudo-integration, PC)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	100	60%	24	62%	5	Intro	POSITION-CONT.	1		
CNTR	23	14%	8	21%		Support	SUP	4		
REFT	21	13%	4	10%	2	Refutation-weak	CNTR-**REFT**	2	Repetition	4
NEUT	0	0%	0	0%		Synth. contingent	SUP	1		
NF	24	14%	3	8%		Concluding	POSITION	1		
Total	**168**		**39**		**7**	Total		**7**		
Posttest										
SUP	57	40%	14	30%		Intro	POSITION	1		
CNTR	40	28%	13	28%		Refutation-deep	CNTR-**REFT**	2		
REFT	41	28%	18	39%	5	Weighing	SUP-CNTR-**REFT**	1	Weak refute Weighing unclear	1 1
NF	0	0%	0	0%		Problem solution	SUP-CNTR-**REFT**	2	Weak solution	1
NEUT	6	4%	1	2%		Concluding	POSITION	1		
Total	**144**		**46**		**5**	Total		**7**		

Table 5.26: Baseline and posttest essay of Fiona (High Pseudo-integration, Paper)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para	Strategy	Composition	No		No
	No	%	No	%	No					
Baseline										
SUP	54	48%	11	46%	1	Intro	POSITION-CONT.	2		
CNTR	36	32%	9	38%	2	Support	SUP	1		
REFT	6	5%	2	8%	2	Weighing min.	SUP-**CNTR**	2		
NEUT	0	0%	0	0%		Weighing	SUP-CNTR-**REFT**	2	Weighing unclear	2
NF	17	15%	2	8%		Concluding	POSITION-QUAL.	1		
Total	**113**		**24**		**5**	Total		**8**		
Posttest										
SUP	38	59%	9	53%	2	Intro	POSITION	1		
CNTR	10	16%	4	24%		Support	SUP	2		
REFT	14	22%	3	18%	2	Refutation	SUP-CNTR-**REFT**	1		
NF	0	0%	0	0%		Refutation-deep	CNTR-**REFT**	1		
NEUT	2	3%	1	6%		Concluding	POSITION	1		
Total	**64**		**17**		**4**	Total		**6**		

Table 5.27: Baseline and posttest essay of Diane (High Pseudo-integration, Paper)

essays include more argument moves, which often are combined in chains of consecutive counter and refuting moves. However, the moves are adequately developed and flow well

Besides improvement in depth, there is great improvement in terms of rhetorical structure in Fern's essay. In her posttest essay, there are no unrelated statement and repetitions, which previously caused problems to the expression of refutation. Fiona also reduced repetition and Diane the clarity of statements Shaun deteriorates in many aspects, both in semantic and rhetorical structure.

5.8.3 High Pseudo-integration group: process change

Diana's writing strategy is the least usual one amongst the three participants. For the baseline essay, she starts with a to-do list (Figure 5.18) where she mainly sets herself the goal to formulate a position. She remains preoccupied about which side of the debate her position inclines while she applies weighing and weighing-minimizations strategies. In other words, she integrates arguments and counterarguments while at the same time she hesitates about her position. After many moments of revising and restructuring her paragraphs and many idle moments of reflection on her to do list, she 'returns to the drawing board' and produces two spider diagrams, one for each side of the debate (Figure 5.19). These include a summary of her existing points and a few new ones. These show that Diana's argumentation schema draws from two positions, thus comparing and weighing arguments from two sides comes naturally.

In the posttest essay, she produces a plan from the beginning of the process (Figure 5.20). The top level textbox is, as instructed, a position statement. The majority of the textboxes are supporting to the position. They are added in a rather erratic manner, albeit most of the semantic links are sound. There is very little counterargument and refutation. The point is, however, that Diana, does not employ weighing strategies in her posttest essay. In this diagram there are very few counterararguments, the links are straightforward, and hence there

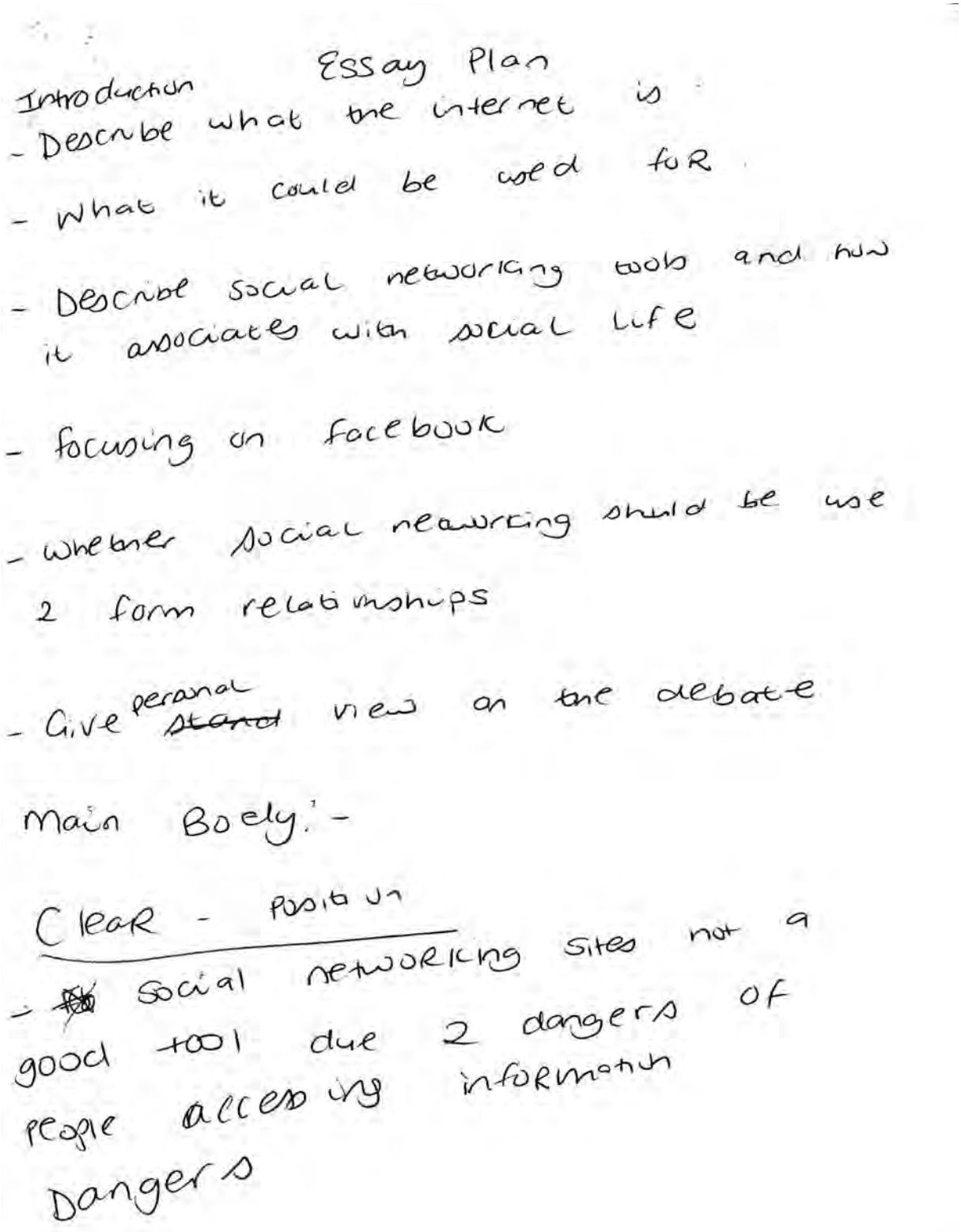


Figure 5.18: Diana's to do list (baseline essay)

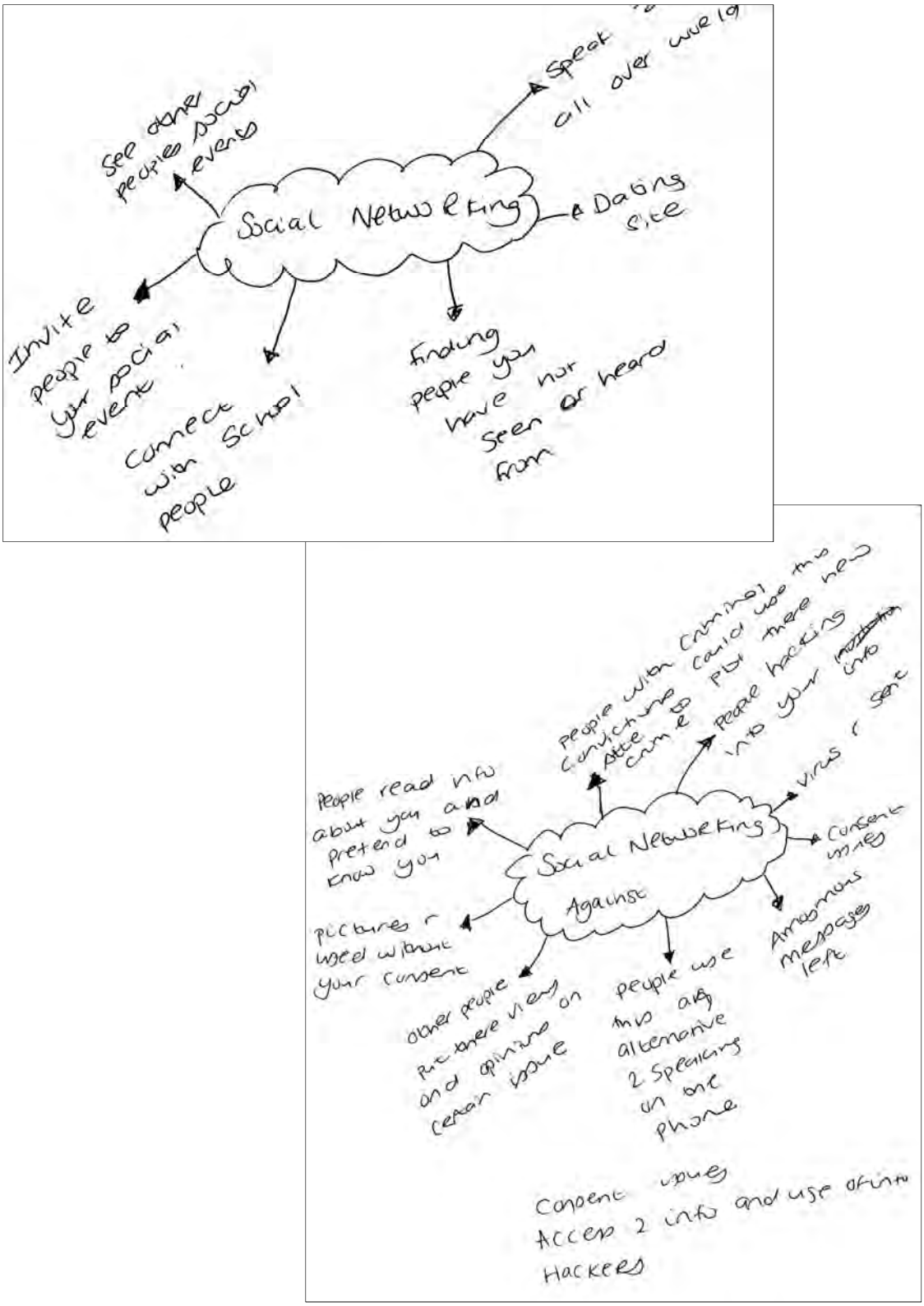


Figure 5.19: Diana's spider diagrams (baseline essay)

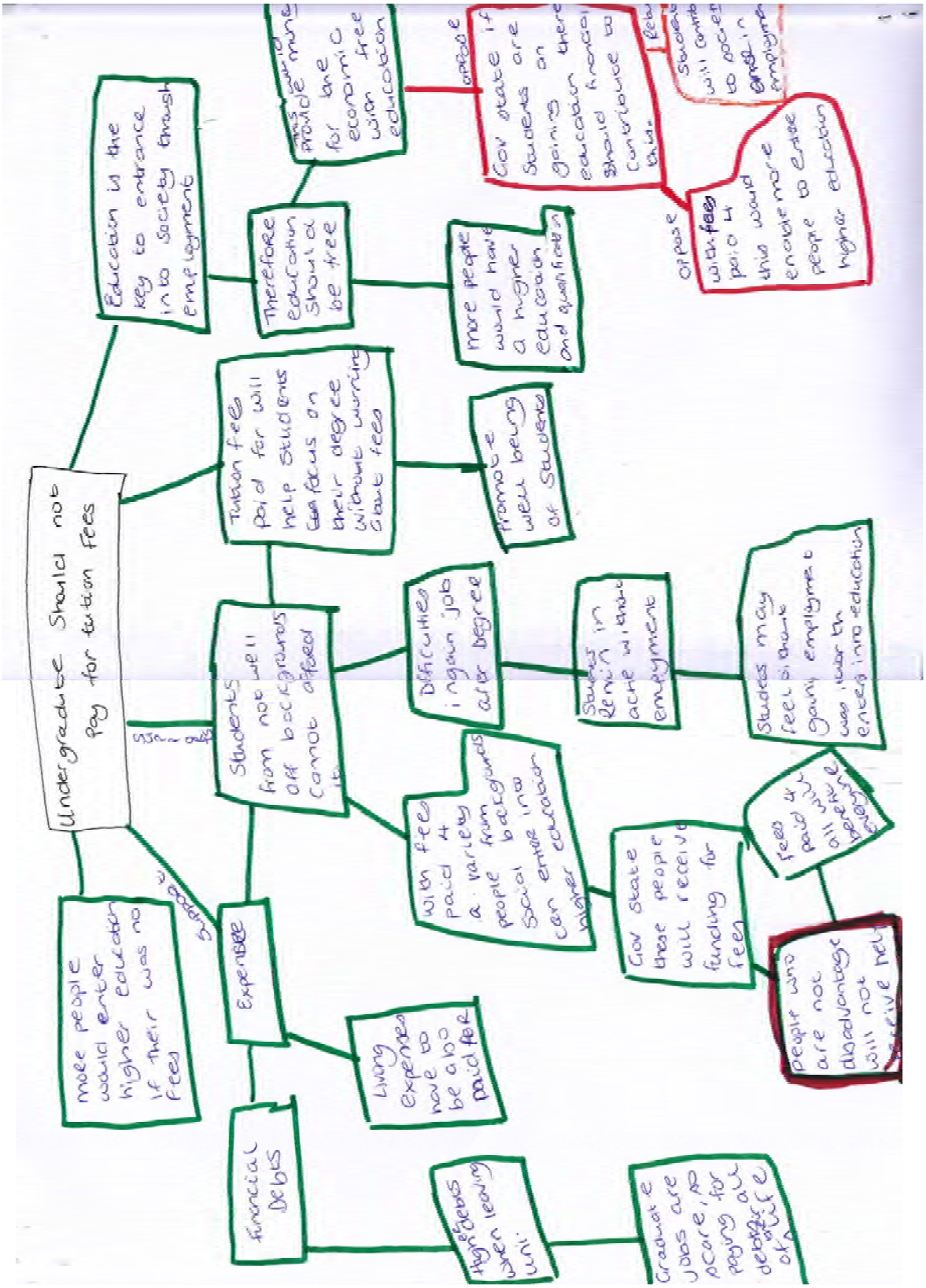


Figure 5.20: Diana's argument diagram

is no need compare and to weigh. In the posttest Diana does not worry about her position so much. She carries on from the plan and writes her essay without 'returning' again to the drawing board. The salient elements of the diagram give her a (false) security that through a transparent process such as the argument diagramming her position acquires validity.

Fiona's experience with argument diagramming could be described in a similar way. She too engages in long and sophisticated planning, transforming and re-transforming the content of an initial brainstorming plan. She examines many aspects of the debate and integrates arguments and counterarguments in weighing and weighing minimization strategies. The same impact, that is, reduction of weighing and weighing minimization strategies is seen in the essays of Fiona, Shaun and Fern's essay. *Shaun* is very driven to explore the diagramming method and develops a large diagram and, in particular, very deep. He then finds it very difficult to translate the excessively long chains into paragraphs.

It is important to note that *Fern* perceives as disadvantage of the argument diagramming method the fact that she has to commit to a simple positive or negative claim as her top level position statement. She remarks that the argument diagramming notation should support the possibility that the writer takes a modified position as early as the beginning of the planning. The position she contemplates is reminiscent of a position-qualification or a synthesis-contingent approach. The extract is from Fern's process transcript (Table 5.28), and in particular as soon she starts working with the Rationale argument diagramming tool.

The point that is being made here is that argument diagramming is causing Fern to take a position without qualification or synthesis contingent approach. This, in its turn, is more likely to dictate adversary strategies rather than conciliatory. Thus the position representation in the current method of argument diagramming favours adversary strategies. It should be pointed out that Fern is sure about her qualified position from the beginning of planning the posttest essay. She does not use the planning process in order to arrive to it. Hence, in the case

where argument diagramming is used to help the writer analyse their position, not being able to represent a modified position is a constraint.

'Thinking about where I stand in the argument, about the debate. I think they should pay tuition fees, because of the improvement in the quality of education, however it is quite controversial because you're closing off higher education to some people, so I think I'm going to take the stand that they should pay tuition fees but not higher… but not make the tuition fees more expensive, so…. Taking a clear stand, so I know what I'm going to say.' \New textbox\ 'My contention is….' [Main assertion] <Students should pay tuition fees to go to university> \She reads aloud the main assertion as she types it\ 'I already think that this should be something that should have 'buts' in it, so…. it is quite controversial, because there should be a lot of help from the Government for those who can't afford it, and also maybe those doing more vocational things. I don't know. No, I do think that…. Reason….' \New textbox (Supports), connected down from the main assertion\ 'First main reason why I support it is because…' [1] <It improves the quality of education and resources>

Table 5.28: Extract from video transcript (Fern, posttest essay)

Although argument diagramming limits writers in applying the weighing strategy, it improves significantly the refutation strategy.

Fern improves the refutation strategy in all possible aspects: in quantity, in quality and in terms of perceiving refutation as valuable criterion of good argumentation. During planning and composing her baseline essay Fern is hesitant about the refutation strategy. In particular, while contemplating the relevant list item at the end of planning, she appears unsure about refutation itself, hesitating to add further content to the plan. This is relevant to the problem she has with inventing and developing refutations in the baseline essays.

In the posttest essay the participant engages with the plan creatively and extensively. She carefully creates an extended diagram, where she opposes every supporting textbox and then she refutes. The diagram textboxes are carefully edited and integrated in the diagram taking extra care of the in-between associations (improved connectivity).

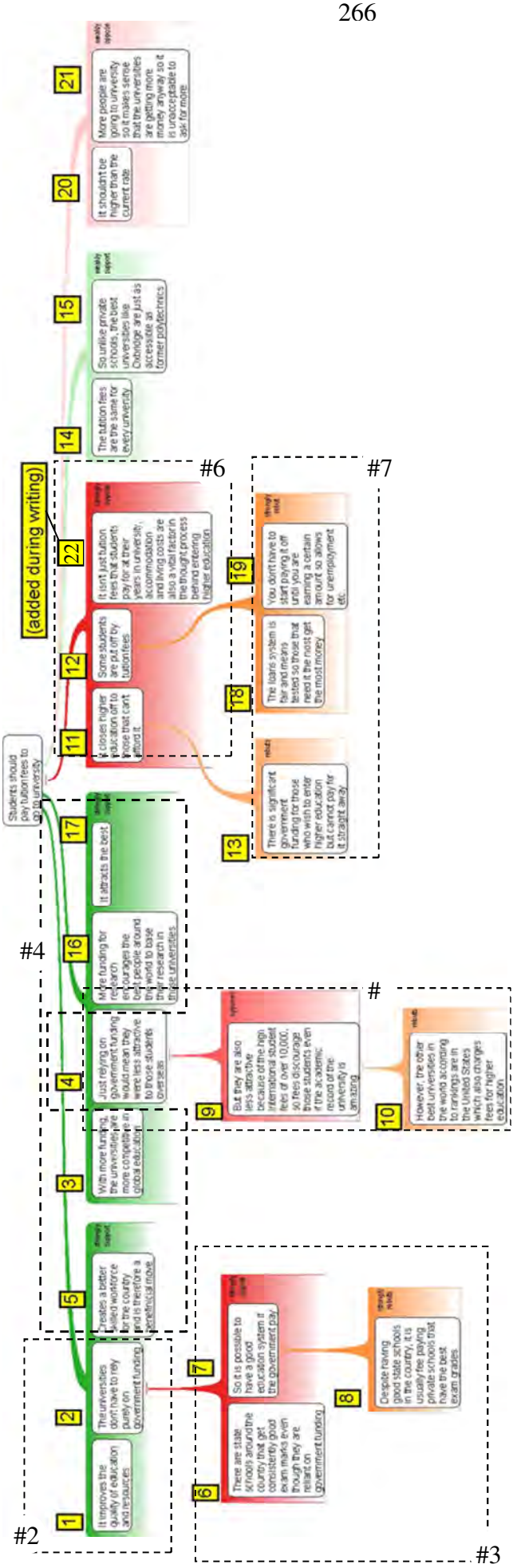


Figure 5.21: Fern's argument diagram

In particular the participant reads carefully the existing textbox before attaching a new one rephrases and expands content in the textbox before moving on, carefully choses wording in textboxes. Development in depth and other rhetorical structure improvements seen in the essays of all tree participants are related with systematic linearization. Fern adopts some sophisticated ones as well. Following an evaluation of the diagram content by assigning strength on textboxes she selects the content that she will include in the text. Despite the initial difficulty with expressing a qualified position Fern appreciates the value of diagramming in improving refutation.

In contrast Shaun's' poor linearization process leads to weak connections in the text. The writer follows a very simple linearization strategy, 'sweeping' the diagram from left to wright, without a clear strategy of prioritization or regrouping of textboxes. He simply switches view to the diagram, copies content by memory, and inserts connecting words. Paragraphs are not rearranged in the end. Upon review of written content he adds passages that are not developed during planning, and are not adequately connected with existing content, resulting in digression.

Process of baseline essay		
	Fern (PC)	**Shaun (PC)**
1. Type of plan	a) Content plan and b) rhetorical plan	Simple network diagram
2. Planning duration	a) 7 minutes and b) 13 minutes of total 1h 26	2 minutes out of 1 h 43
3. Plan entries	22	9
4. Ideas/arg. generation	Elaborating and transforming content plan	Ideas generated during composing
5. Essay position	Defined in the beginning of planning	Defined while composing, changes from one position to another
6. Criteria list	Confirming	Guiding
7. Reflection on planning	Extended.	No
8. Plan to text linearization	Relies mainly on rhetorical plan	No
9. Rhetorical plan	yes	No
10. Interleaving	Yes, to add points to plan twice	No
11. Revision	Limited revision. Final reviewing of essay	Revises extensively locally and globally
Process of posttest essay		
1. Type of plan	a) Computer-based b) Computer outline	a) Paper-based b) Computer-based
2. Planning duration	a) 28 b) 4 of 1h and 30 minutes	25 minutes of 1h 20 minutes
3. Plan entries	22, 9 support, 8 counter, 5 refute	18, 9 support, 6 counterargument, 3 refutation. Very deep structure 10 levels
4. Diagram content generation	Developing trees in depth	Developing trees in depth
5. Essay position	Defined in the very beginning of planning	Defined in the beginning of planning
6. Criteria list	Minimal use	Confirming
7. Reflection on diagram	Reflects on balance of argument making sure to expand counter and supporting side equally	Perceives analysis in two trees one support on countering position.
Semantic connectivity of diagram	Very good, good use of co-premise notation, playing the role of warrant	Good
8. Diagram to text linearization	Prioritization of arguments using the evaluation function	Ineffective: more than one branches are included in the same paragraph.
9.Rhetorical plan	Use of automatic outline. Rearranges diagram and re-produces automatic outline.	No
10. Interleaving	No	No
11. Revision	Final reviewing of essay	Final reviewing of essay

Figure 5.22: Process measures for Fern and Shaun (High Pseudo-integration group)

Process of baseline essay		
	Fiona (Paper)	**Diana (Paper)**
1. Type of plan	a) including spider diagram b) rhetorical plan	a) to do list, no topic content just position –INTERLEAVING TEXT- b) two spider diagrams for each side 'for' - 'against' only
2. Planning duration	a) 3 minutes b) 12 minutes of total 1h 50	a) 3 minutes b) 5 minutes of total 1h 34 minutes
3. Plan entries	a) 20 b) 21	a) 12 entries b) 33 entries summary of text
4. Ideas/arg. generation	First brainstorming and then organising in outline, introducing new points	Ideas are generated during first 50 minutes of writing, then are summarised in two spider diagrams
5. Essay position	Defined by the end of planning	Preoccupied with position throughout essay writing and post hoc planning
6. Criteria list)	Confirming	Guiding very closely
7. Reflection on planning	Extended, focusing on orientation of arguments and linearization	Stating with a 'to do' list that mainly says to take a position
8. Plan to text linearization	Systematic, drawing from outline	Inverse: Text is turned into plan to facilitate reflection on position
9. Rhetorical plan	Yes, rewritten to provide emerging themes	No rhetorical plan
10. Interleaving	No	Yes, 50 minutes after writing
11. Revision	Preoccupied with paragraph level structure	Local revising during composition
Process of posttest essay		
1. Type of plan	Paper- based diagram	Paper-based diagram
2. Planning duration	35 minutes of total 1h 50	25 minutes of total 1h 40 minutes
3. Plan entries	37 entries, 7 support, 18 counterargument , 12 refutation	24, 19 support, 3 counter, 2 refutation
4. Diagram content generation	Develops each tree in depth.	Switches between trees while supporting, focused during refutation
5. Essay position	Defined in the beginning of planning	Defined in the end of planning confidently
6. Criteria list	Confirming	Confirming
7. Reflection on diagram	Preoccupied with connectivity aiming to invent extended content	Preoccupied with introducing counterarguments in view of many supporting
Semantic connectivity of diagram	Good	Good, but with a few issues
8. Diagram to text linearization	Following closely diagram. Selection of relevant content	Following closely diagram
9.Rhetorical plan	Yes, reorganising diagram in plan	No
10. Interleaving	No	No
11. Revision	Preoccupied with paragraph level structure	Local revising during composition

Figure 5.23: Process measures of Fiona and Diana (High Pseudo-integration group)

5.8.4 Concluding remarks for the High Pseudo-integration group

In this group, the damaging effects of argument diagramming start to even out its benefits. In particular this group has demonstrated 4 critical improvements and 4 deteriorations (Table 5.29). This is especially the case for the semantic aspects of the essay. The increase of refutation is the only critical improvement in the semantic structure of the essay, introduced as the result of argument diagramming. Refutation, being the most salient aspect of this diagramming method, is affecting all levels of argument-counterargument integration, including the higher ones such as High Pseudo-integration group.

As for the more damaging effects, the method brought a retraction from positions with qualifications or contingent positions to simple one-dimensional positions (almost the reverse of the effect witnessed in the last group). This seems to be connected with another trend of the method to prompt writers to narrow down their integration strategies, allowing the refutation strategy to prevail in the planning process. This is a matter of role expressiveness of the diagram notation; the inflexibility of the method, which at least according to the participating writer, does not allow the expression of more sophisticated positions (synthesis-contingent, synthesis qualification), is instrumental in this damaging effect. The writer perceived the method to enforce flow of arguments and statements out of a single contention box in a hierarchical way (top-down).

Similarly in rhetorical terms, the tool has contributed the formation of long and difficult to read chains of counterarguments and refutations. The tool brought forward a very erratic planning process with arguments added in the plan without any clear logic, shifting from one side of the diagram to another. Here again the tool demonstrated the reverse impact compared to the impact realised among writers in the last two groups (where the tool was used to impose structure in an erratic baseline process).

The method has brought some benefits in terms of improvement of thematic continuity through the extra attention paid by the writer in the connections between different textboxes. The method has also brought some benefits in the relevance of content to the essay position through the use of the evaluation functionality of the software version of the method (a functionality seen in previous groups also).

Semantic changes	**Associated Processes**		**ArgD**
Retract from position with qualifications or position contingent to simple position	Argument diagramming cannot represent a synthesis position	PL	PC
	Writer confined to use the argument diagramming to generate one plan in contrast to baseline essay where the writer produced two different plans	PL	Paper
Blurred position	Position formulated on the basis of a weak refutation.	PL	PC
Increase of refutation	Introduces many counterargument and refutation textboxes	PL	PC & Paper
Integration strategies narrow down to refutation strategy mainly	Writer develops a long tree with inter-connected textboxes but all trees flow of a single position	PL	PC & Paper
	Introducing counterarguments and refutation in diagram prevails the planning process	PL	
Rhetorical changes	**Associated Processes**		**ArgD**
Improvement of thematic connectivity	Diagram textboxes are carefully edited and integrated in the diagram taking extra care of the in-between associations	LN	PC
	Deciding on grouping of arguments in paragraphs by reflecting and interacting on diagram	LN	PC
Long & difficult to read chains of counter and refutations	Very erratic planning in argument diagramming, shifting from one side of the diagram to another	PL	Paper
	Very complicated links between arguments in posttest essay in contrast to simple linkages in baseline plan	LN	Paper
	Including a very long chain of textboxes in one paragraph, results in complex and difficult to read paragraphs	LN	PC
Development in depth	Good use of co-premise text box, playing the role of 'warrant'	PL	PC
Improve relevance of content	Some diagram content is excluded from the text, after evaluation with strength assigning function	PL	PC

PL = Planning, LN = Linearization, Inter = Interleaving, WR = Writing
Green cells = improvement compared to baseline; Red cells = deterioration compared to baseline

Table 5.29: Text changes and associated processes in posttest essay in the High Pseudo Integration group

5.9 Integration group

5.9.1 Integration group: baseline text

Liana, Billy and Deana are considered in the Integration group. This group is characterised by successful integration of arguments and counterarguments. Their baseline essays are characterised by the following:

1. The **essay position** is clear and integrates both sides of the debate in one position. Billy, for example develops a "synthesis-contingent" position (see also section 4.3.2, p.143), i.e. he concludes to a compromise position that defines the condition under which the position holds:

> *To summarise, I personally believe that it is not right to start relationships through social networking sites like Facebook; it is riskier because you are talking to a stranger who may not be who they initially appear to be. However, I see no problem with developing and nurturing existing links with other people by means of the internet, as it is a useful tool to get to know them better (Billy, conclusion, baseline essay).*

Deanna also includes both sides of the debate in her final position. Her position is a "Synthesis-creative solution", i.e. it first defines the problematic aspects of the debate and then suggests a course of action that bypasses a problem (see also section 4.3.2, p.144).

> *I therefore would conclude that though paying tuition fees would help in creating revenue for the government to invest and improve the quality of the service, the fact that so many people would stand to lose if fees were high would deter from this being a good idea. Similarly though, the problem of people going to university solely to have a good time and avoid having to find employment is clearly a crucial factor in deciding instead that tuition fees should be paid. However personally I think the current system under the Labour government, of highly subsidized and therefore not free but still affordable fees, is the most successful. With highly subsidized fees the government is still able to alert people to the fact that it is an accessible option but without*

> *attracting people who will not make the most of it since they still stand to lose substantially by attending university without the motive to learn. Subsidies therefore are the best way of both eliminating the prospect of some sectors of society being alienated as well as ensuring there is enough money in the system for innovation and quality of teaching (Deana, conclusion, baseline essay).*

Deana does not integrate a refutation strategy in the baseline essay. Counterarguments are presented as extensively as the opposing position in the main body of the essay. Integration takes place in the conclusion, as seen above, after presenting both sides of the debate.

2. The range of **argumentation strategies** includes both adversary and conciliatory strategies. These are both argument and counterargument integration strategies but with a characteristic difference. Refutation strategies (both weak refutation and deep refutation) are adversary strategies, aiming to invalidate counterarguments by showing that they are false, irrelevant, or insufficiently supported. Conciliatory strategies express compromise, middle ground, synthesis of opinions and moderated positions. Weighing, weighing-minimization, synthesis-contingent, and synthesis and creative-solution are conciliatory strategies. Conciliatory strategies appeared in Pseudo-integration groups, however in this group they are used consistently in the expression of the position as well as in other argument moves (see Paragraph schema of concluding paragraphs at baseline Table 5.31, Table 5.32, and Table 5.33)

3. In terms of **argumentation balance** it is observed that two types of opposing argument moves are balanced. For example, counterargument moves and refutation moves are balanced in Liana's (Table 5.31) and Billy's essay (Table 5.33). In Deanna's essay there is a balance between supporting and countering moves as refutation moves are not employed at all (Table 5.32). The balance in terms of opposing argument moves shows that both sides of the debate are equally developed.

4. **Argument-position coherence**: The balanced development of argumentation and the integrative position of the essay are in agreement. The balanced argumentation developed in the essay is reflected in the position of the writer.

5. **Integration strategy**: In this top level group no integration problems are reported.

The common characteristic of the three participants is that they include successfully a wide range of strategies building up to an integrative position. Their argumentation schema is the most advanced amongst the 16 participants of the study. However, not all three improve their essays after they use the argument diagramming method. Table 5.30 summarises the improvement and deterioration in terms of semantic and rhetorical structure.

After using the diagramming method *refutation* is increased in all three posttest essays in terms of argument moves (Liana +11%, Deana +22%, Billy +16%, in Table 5.31, Table 5.32, and Table 5.33 respectively). Liana increases both argument moves and the sum of all refuting EDUs. However, in Billy's case, while refuting argument moves increase, the refuting EDU decrease by 8%. EDUs are fewer than argument moves, which indicates that Billy's refuting argument moves are shorter in depth in the posttest essay. Deana develops refuting argument moves only in the posttest essay. Nevertheless, there are implications for her in adopting a new argumentation strategy.

Integration	Liana (Paper)		Deana (Paper)		Billy (PC)	
Semantic argumentation parameters in baseline	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
1. Essay position: integrates **both sides** of the debate in one position	√	√	√	X	√	X
2. Range of integration strategies: adversarial and conciliatory	√	√	√	X	√	X
3. Argumentation balance: balance between two types of argument move (CNTR-REFT, or SUP-CNTR)	√	√	√	√	√	√
4. Argument-position coherence: argumentation reflects the writer's position	√	√	√	√	√	√
5. Integration strategy issues: No issues	√	√	√	√	√	√
Rhetorical argumentation parameters in baseline	BASL	ARG.D	BASL	ARG.D	BASL	ARG.D
A. Rhetorical structure organisation: Thematic continuity	X	√	√	√	√	X
B. Juxtaposition: paragraphs or arguments juxtaposed without being weighed out	X	√	X	√	N/A	N/A
C. Development of depth: Shallow development of paragraphs or statements, short paragraphs, abrupt switching between argument moves and chains.	√	√	X	√	X	√
D. Relevance: Digression/Topic drift, Unrelated statements	N/A	N/A	X	√	N/A	N/A
E. Clarity: Unclear statements	X	√	X	√	N/A	N/A
F. Repetition: (Can be related to refutation or supporting arguments.	N/A	N/A	N/A	N/A	N/A	N/A
KEY: BASL: baseline, ARG.D.: posttest, √ confirms existence of element, X shows absence of element, green shade: improvement, red shade: deterioration						

Table 5.30: Integration group progress in argumentative text

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para					
	No	%	No	%	No	Strategy	Composition	No		No
Baseline										
SUP	72	59%	15	68%	5	Intro	POSITION	1		
CNTR	14	11%	2	9%		Position	SUP	5		
REFT	26	21%	3	14%	2	Refutation-deep	CNTR-**REFT**	1		
NEUT	7	6%	1	5%		Weighing min.	CNTR-**REFT**	1	Unclear	2
NF	3	2%	1	5%		Concluding	POSITION-CONT.	1		
Total	**122**		**22**		**7**	Total		**9**		
Posttest										
SUP	60	49%	15	54%	2	Intro	POSITION	1		
CNTR	26	21%	5	18%		Position	SUP	2		
REFT	35	29%	7	25%	4	Refutation-deep	CNTR-**REFT**	2		
NF	0	0%	0			Weighing min.	CNTR-**REFT**	1		
NEUT	1	1%	1	4%	1	Weighing	CNTR-**REFT**	1		
Total	**122**		**28**		**7**	Juxt adv-disadv	NEUT	1		
						Concluding	POSITION-CONT	1		
						Total		**9**		

Table 5.31: Baseline and posttest essay of Liana (Integration - Paper

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para					
	No	%	No	%	No	Strategy	Composition	No		No
Baseline										
SUP	54	52%	11	48%	2	Intro	POSITION	1		
CNTR	44	42%	11	48%	3	Position	SUP	2		
REFT	0	0%	0	0%		Counterargument	CNTR	1		
NEUT	0	0%	0	0%		Weighing min.	SUP-**CNTR**	2		
NF	6	6%	1	4%		Concluding	POSITION-SYN.-SOLUTION	1		
Total	**104**		**23**		**5**	Total		**7**		
Posttest										
SUP	41	35%	7	30%	1	Intro	NEUTRAL	1		
CNTR	42	36%	10	43%		Position	SUP	1		
REFT	21	18%	5	22%	3	Weighing min.	CNTR-**REFT**	1		
NF	0	0%	0	0%		IRRELEVANT	CNTR-**REFT**	1	Unrelated	1
NEUT	12	10%	1	4%		Juxt adv-disadv	CNTR-**REFT**	1	Unclear Unrelated	1 1
Total	**116**		**23**		**4**	Concluding	POSITION-QUAL.	1		
						Total		**6**		

Table 5.32: Baseline and posttest essay of Deana (Integration – Paper)

Arguments Orientation						Paragraph schemata			Problems	
	EDU units		Arg. moves		Para					
	No	**%**	**No**	**%**	**No**	**Strategy**	**Composition**	**Count**		**No**
Baseline										
SUP	48	56%	11	69%	4	Intro	NEUTRAL	1		
CNTR	7	8%	2	13%	1	Position	SUP	3		
REFT	23	27%	2	13%	1	Refutation-deep	CNTR-**REFT**	1		
NEUT	0	0%	0	0%		Weighing minimiz.	SUP	1		
NF	8	9%	1	6%		Synth. contingent	**CNTR**-REFT	1		
Total	**86**		**16**		**6**	Concluding	POSITION-CONT.	**1**		
						Total		**8**		
Posttest										
SUP	35	38%	9	38%	3	Intro	HINTED POSITION	1		
CNTR	33	35%	7	29%	1	Position	SUP	3		
REFT	18	19%	7	29%	5	Counterargument	**CNTR**-REFT	1		
NF	0	0%	0	0%		Refutation	CNTR-**REFT**	2		
NEUT	7	8%	1	4%		Refutation-weak	CNTR-**REFT**	3	Depth	3
Total	**93**		**24**		**9**	Concluding	POSITION	1		
						Total		**11**		

Table 5.33: Baseline and posttest essay of Billy (Integration – PC)

5.9.2 Integration group: text change

In terms of applying a *wide range of argumentation* strategies *Liana* improves the most in the posttest essay, while Billy and Deana deteriorate. Liana doubles the occurrence of the deep refutation strategy and introduces the weighing strategy. She retains the weighing-minimization strategy and synthesis-contingent position (Table 5.31). The weighing strategy enhances the application of conciliatory strategies but it is not applied as successfully as the refutation strategy (juxtaposition). In *Billy*'s posttest essay the range of strategies narrow down to refutation strategy. In contrast, in his baseline essay he included weighing and synthesis-contingent strategies comfortably and effectively (Table 5.32). Furthermore, in the posttest essay the *essay position* is less integrative referring to supporting arguments only:

> *On balance, I strongly oppose tuition fees, as it is a superfluous expense that the government has imposed on students as a result of needing more money. The proposition from politicians rising fees even further is completely and utterly the wrong way to conduct the process of higher education. This would make higher education more elitist and, in the end, only open for the rich. This is clearly not right at all, as the UK is supposed to be a modern, developed country, which less developed countries can follow, and which is meant to give every member of society equal opportunities. There is no 'equal' in tuition fees, because it puts an extra strain on a group of society who is already poor as it is! (Billy, conclusion, posttest essay)*

In Deanna's case, relevance and clarity issues emerge when she attempts to respond to counterarguments in the posttest essay, that is, while she tries to pilot strategies beyond her existing ones. A whole paragraph, in which she refutes a counterargument, is completely irrelevant to the essay question. In another passage, where she tries to relate a counterargument to a refutation, the composition becomes contrived and unclear (juxtaposition).

> *Also, some could argue, that meeting people online and having this endless choice of singles available on websites encourages people not to settle down and thus ruins the family ideal that our country is apparently based on. Similarly some argue that meeting people in the conventional way, not on a computer, also has it's (sic) benefits and these should be utilised. However, in response to this it is possible to argue that the technology has been invented in order to make our lives easier and to extend options for us and therefore should be used accordingly and taken advantage of (Deana, posttest essay).*

The weighing minimization strategy is reduced too. Deana appears to have deteriorated the most amongst the integration group.

In terms of *rhetorical structure*, Liana's essay is again the one that improves the most. In the main body, incoherence issues (such as unclear passages) are eliminated. Furthermore, the thematic flow of the essay also improves. In the baseline essay, all paragraphs were related to the position through a coordination structure. In the posttest essay, there is better thematic flow, as paragraphs relate to previous and next ones, either thematically or by orientation (e.g. antithesis relation between paragraphs.). In contrast, Billy's essay deteriorates in terms of thematic flow. In his baseline essay, the coherence between paragraphs and conclusion is very good (possibly exemplar), the themes are organized transparently, helping the reader to follow the argument connections easily. In the posttest essay the flow is interrupted many times. Uses of connectives, such as "similarly", "on the other hand", "evidently", are used many times, while the connecting arguments are not developed in depth. This deterioration in text flow is related with the increase but short argument moves.

In Deana's posttest essay, there is also problem with short argument moves. In her baseline essay, ideas were well developed in depth, with supporting arguments and examples and well linked arguments. In the posttest essay, paragraph structure issues and relevance problems appear. The paragraphs are very long (280 words on average) while they increased by 80

words on average, including a paragraph of 600 words. Paragraphs also include long chains of argument moves. In contrast the argument moves are reduced in length. This is also shown by the larger percentage of countering or refuting argument moves in relation to smaller percentage of corresponding EDUs (Table 5.32: Counter: moves 43% > 36% EDUs; Refutation: moves 22% > 18% EDUs).

5.9.3 Integration group: process at baseline

The advanced argumentation schemata of the Integration group participants are traced in the planning process of the baseline essay. *Liana* engages in 13 minutes of planning during which she is immersed in an interaction between supporting argument, counterarguments and refutations (Table 5.34). Figure 5.24 shows Liana's plan, a kind of spider diagram, which starts from the middle of the page and branches out to the right to the position statement "Should pay tuition fees". On the right side she outlines the supporting argument (annotated in green) and on the left side of the page she includes counterarguments (numbers in red). Six refutations (number in orange) are attached to the counterarguments. At the bottom of the page Liana included two statements (22 and 23) which summarise her conclusion. During writing she organises the existing points and argument moves in paragraphs.

The lively internal dialogue between arguments and counterarguments (Table 5.34), as well as the output of the planning process, provide ample evidence of Liana's advanced schema: she includes counterarguments and refutation in her baseline plan; she establishes semantic links between them, and at the bottom of the paper she concludes.

Figure 5.24: Liana's plan at baseline essay (numbers added for illustration)

‘I’ll come back to that, but there are counterarguments as well for the other side.’
[10] <Counterarguments>
/She reads aloud [10] as she writes it/
‘So that’s like, paying tuition fees, some people would say that only rich people can afford it,
so it’s excluding less affluent backgrounds.’
[11] <Only rich people can afford – excluding less affluent backgrounds>
‘But then you could say about that that there’s the loans system in place so that everyone can afford it.’
[12] <loans system in place so everyone can afford>
‘I think you have to pay back 9% when you earn over a certain amount...’
[13] <9% when you earn over a certain amount>
‘…which isn’t too bad.’
/Pauses/
‘Another counterargument is if you didn’t pay tuition fees then more people would be better qualified.’
[14] <More people better qualified – more people with more value to society. Stop people dropping out of school>
/She reads aloud [14] as she thinks and writes it/
‘But the other thing is, do you want the people who’d drop out of school at uni?’
[15] <do you want the people who’d drop out of school at uni>
/Pauses, reviewing diagram/
‘What else? Probably another counterargument to that. It would mean there was a shortage of young people in the workplace and more competition for courses.’
[16] <mean there was a shortage of young people in workplace>
[17] <more competition for courses>
‘So more people would probably want to go to uni than there were spaces. Could be a problem.’
[18] <more people wanting to go to uni than there were spaces>
‘Ok.’
/Pauses, reviewing the diagram/
‘So that’s two counterarguments, I need another argument. Well I’ve got two of them two. Why should we pay?’
/Pauses, thinking; studying the diagram/
‘Well, the people who want to be there are more likely to work harder, especially ‘cause they’ve paid for it. And then you get value for their money.’
[19] <more likely to work harder, especially as paid for it – get value>

Table 5.34: Video transcript extract (Liana, baseline)

Billy engages in 12 minutes of systematic planning before writing the baseline essay. He constructs a rhetorical outline (see Table 5.36) making sure to include points for the introduction, main body and conclusion of the essay. The video transcription extract below (Table 5.35) shows that Billy possess the argumentation schema of refuting, weighing and introducing a synthesis-contingent position. Critical points of his plan (Table 5.36) are mapped in the think aloud script (Table 5.35).

Billy is able to self-regulate the application of refutation and weighing strategies almost in parallel. He first introduces a counterargument, prompted by the criteria list, then reflects and weighs out the point, and later returns to introduce either a refutation or a statement that counterweights the strength of the counterargument. The argumentation moves, which contribute to a refutation or a weighing strategy, do not take place in a linear way during Billy's planning. Refuting a counterargument is interleaved, for example, by consideration of topic relevance, or by considering another counterargument. The extract also shows Billy confirming the synthesis-contingent position that he had taken as early as the beginning of planning "Well, maybe not to build relationships. No, I think it's best to build relationships face to face, but people that you know, you can use Facebook for, I would say, it's more acceptable". The points he introduced in the outline and the video extract are consistent with this position.

Billy is also monitoring the ideas invention process and regulates himself so that he 'stays on the point'. He continues with writing up his points following and developing further the points of the plan. Referring to the criteria list is sometimes guiding him but it is mainly used to confirm his actions. Overall Billy is a competent writer showing familiarity with an effective planning strategy, ability in integration strategies and strong self-regulation skills.

Extract from video transcription (00:03:30 to 00:07:17 of total 2:10:00)	**Annotation**
/He turns his attention to the list of criteria and says, '…providing reasons as well…' as he reads/	
****He ticks 1 Supporting Reasons****	
/He reads aloud criteria 3/	
'Let's see. What are arguments on the other side?'	
/He returns to the diagram/	
'Let's have a think.'	
/Pauses, thinking/	
'I suppose there's the argument that it's easier to contact people on the internet…'	Counterargument
[12] **a**<-easier to contact people>	
/He pauses, looks away from the diagram and says, 'But then is it?'/	
'I suppose people don't have to be online to leave a comment, but you do to use Facebook chat.'	
/Pauses, with pen poised to continue [12]/	
'I suppose you can see what people look like from their photo, but then the photo isn't always of them…'	Weighs out counterargument
/He continues to pause/	
'Oh, I'm being so indecisive, typical'	
/He continues to read the diagram and pauses, thinking/	
'Easier to contact people…'	
/He turns to the criteria list/	
****He ticks 1 Counter Argumentation**** without hesitation	
/He returns to the diagram/	Prompting himself to add refutation
'…on the internet… but… but…'	
/He adds **b**<on internet, but> to [12]/	
/Pauses, thinking/	
'I don't know.'	
/He turns to the criteria list/	
****He ticks 1 Refutation****	
/He returns to the diagram/	
'I need to think of more arguments.'	Prompting himself to think of counterarguments
/He rests his head in his hand as he thinks/	
/He points they pen at [9] or [10] as he thinks/	
'Come on Rees, there's loads.'	
/Pauses/	
'No actually, you can find out a lot about a person from their Facebook page, I find.'	
[13] **a** <-find out a lot about people from FB page>	Counterargument
'I suppose, yeah, it gives you most people kind of describe themselves on the page, so therefore it's easier for people to kind of get an impression of the sort of person they are. Yeah, that's true.'	
/He pauses with his pen poised to continue [13]/	
'What else can you do?'	Self-regulating: to 'stay on the point'
/Pauses/	
'A lot of games and stuff on Facebook, but.... I'm kind of going off the point there a bit.'	

/He continues to think, looking away from the diagram/ /He returns to the diagram/ /He reads aloud [13] so far "find out a lot about people from FB page"/ 'But I suppose that can be helpful for people you already know, but maybe not that well, just maybe people that you, say, met at school or at uni but not really talked to that much.' /While saying this he seems to write something on the diagram but this out of view/ /He glances at the criteria list/ 'I don't think you should start relationships on Facebook, but to build them I suppose that could be developing existing ones.' /He turns to the criteria list and points the pen at the question printed at the top/ /He looks away and then back to the diagram/ /He looks briefly at the criteria list/ 'Yeah, so I think…. Do I take a clear stand? I think… yeah, exactly, well I think my conclusion should be that I don't think it's right to kind of start relationships on social networking sites, but it might be acceptable to develop existing ones.' /He adds to [13]: **b** <but can be useful for people you already know>/ /He starts reviewing the diagram/ /He points the pen at [11]/ 'Yeah, that's helpful when you first meet someone, people's expressions.' /He adds to [11]: **b** <– helpful when 1st meet someone>/ /He reads aloud [12] "a<-easier to contact people>b<on internet but>"/ 'But yeah, I think it's more rewarding. More rewarding?' /He points the pen at [12]/ 'It just kind of feels better being with someone than just speaking to them on the internet, it's just not the same.' /He reads aloud [12] again, preparing to add to it/ 'More satisfying?' /He adds to [12]: **c**<more satisfying when with that person, especially if they're new>/	Weighs out counterargument Confirming his synthesis position followed by …… a point expressed as a synthesis contingent strategy (see point [13] in rhetorical outline (Table 5.36). This [11]b is later added in text as counterargument, and then is refuted Refutation to previous (b). This [12] is also added in text as refutation

Table 5.35: Extract from video transcription of Billy's planning process during baseline essay

[1] Introduction [2] Facebook [3] younger generations [4a] <internet [4b] usage soared> [5] <developing technology> [6] <easier for people to meet others through friends pages> [7] <But is it right to form relationships through FB?>	INTRODUCTION
[8] <Main body>	
[9] <-Conversations quicker face-to-face> [10] <Leave comments / use FB chat - wait for reply>	POSITION SUPPORT
[11] a<-people's expressions - don't get on internet> b<helpful when first meet someone> c<heavy internet usage can lead to depression> [12] a<-easier to contact people>b<on internet but> c<more satisfying when with that person especially if they are new>	REFUTATION - DEEP
[13] a <-find out a lot about people from FB page> b<but can be useful for people you already know> c<e.g. at uni - my experience> <especially if a bit shy>	SYNTH. CONTINGENT
[16] <People might not be who they say they are - hear different stories>	POSITION SUPPORT
[20] <Whereas new wealth of these networking sites – may be harming young people's social skills at a time when they need developing most> <as they're unleashed into the wider world of young adults> [22] <development?>	WEIGHING MINIMIZATION
[14] <Conclusion> [15] <not right to start relationships on FB > [17] <less safe, a stranger> [18] <but there's no problem with developing existing relationships> [19] <useful to get to know them better at least you know it's them>	POSITION SYNTHESIS CONTINGENT

Table 5.36: Handwritten rhetorical outline of Billy during baseline essay with annotations

Deana provides a rich think aloud protocol while she is planning and writing her essay. She produces an outline, referring to supporting arguments and counterarguments. However, consistently with her essay, the outline does not include refutations. While composing her essay she monitors carefully the connections between ideas and paragraphs. She is also very aware about avoiding digressing from the topic and she skilfully selects the ideas she includes in the essay. She reflects extensively about how her final position will emerge from the points she is making. She is preoccupied about how to present her supporting and opposing arguments so that, first, she avoids being biased and, second, her position in the conclusion integrate opposing views. The following extracts show how she stays focused on these goals.

Reflecting on her outline she says: 'I think I'm going to go and make positive points in order to balance out the argument because…' /She glances briefly at the diagram/ '…right now it's very one-sided.'
After completing with planning the essay and while composing the first paragraph: /She stops typing and says, 'So I'm only making negative points now, I'm going to go onto the positive points towards the end…'/ /She looks at the diagram while saying this/ '…so that I can evaluate them in my conclusion.'
While composing the conclusion: She stops and looks at the diagram and says, 'I'm trying to weigh up the two points in order to make it clear…'/ /She returns to the computer screen/ '…why I've concluded what I've concluded.' /Stops typing and says, 'I'm trying to bring in all points that I've made before into…'/ /She looks at the diagram and then back to the essay/ '…short… yeah… . I'm concluding them as separate sentences in my conclusion…' /She glances very briefly at the diagram/ '…in order to make my conclusion in well balanced and I've considered everything over again, in order to make the conclusion that I've made.'

Table 5.37: Video transcription extracts (Deana, baseline essay)

5.9.4 Integration group: process change

Deana's essay deteriorates in relation to the baseline essay. In fact her essay deteriorates the most amongst the three participants. Problems related to clarity, relevance and development in depth appear in the text as she attempts to respond to counterarguments. The difficulty with integrating counterargument and refutation is traced i) in the application of the diagramming method and ii) in the lack of reflection while planning the posttest essay.

Deana engaged for 24 minutes (out of total 1 hour and 30 minutes) in planning the argument diagram shown in the following pages (Figure 5.25 shows the original diagram and Figure 5.26 is a transcription of the diagram). The hand drawn diagram is arranged very neatly on an A3 page allowing plenty of space for expanding it, and clearly showing the connections and the sub tree formations. However, weak textbox links, and the order with which Deana added the textboxes on the diagram, indicate a rather 'untidy' structure.

Deana produced the textboxes of the diagram erratically, shifting from one side of the diagram to the other. Very few times are textboxes consecutively constructed on Deana's diagram (showing with the blue arrows on Figure 5.25). This scattered manner of building up the diagram may be useful in the beginning of the planning, or at some other stage, when the writer struggles with retrieving ideas. However, many times writers focus and develop one tree before expanding on another. Deana never does this. This way of developing the diagram leads to creating weak textbox links (see for example those marked with x on them) and irrelevant content. The content of a whole sub tree (showing with the dotted outline on Figure 5.25) is irrelevant with the essay question. Deana's self-regulation skill to stay on the point, as seen in the baseline essay, is not applied here. It is indicative of the way Deana applied the diagrammatic method that she never read or reviewed the sub trees of the diagram from top to

bottom. Textboxes are added in an ‘opportunistic’ manner by association to hanging textboxes.

Another noteworthy change in Deane process is the almost complete elimination of think-aloud speech while planning and translating the posttest essay. This is in contrast with the extended and confident account of the process she is giving during the first essay. In comparison to the first essay, Deana has also reduced the times that she pauses to reflect on how she has been organising her writing so far and how she is about to organise it.

Finally, Deana followed loosely the content and structure of diagram during writing the essay. Paragraph organization does not emerge from interacting with the diagram. She elaborates on the irrelevant points made on the diagram and develops these in a full paragraph. She ends her essay without revising it.

Deana appeared to be a confident writer, who was able to give a reflective account of her process during the baseline essay. However, the introduction of the diagramming method changed drastically her behaviour. She became less reflective on the process and less attentive to the content. She failed to use the method in order to improve her argument and counterargument integration schema. It is possible that confidence in combination with lack of reflection lead to a complacent attitude.

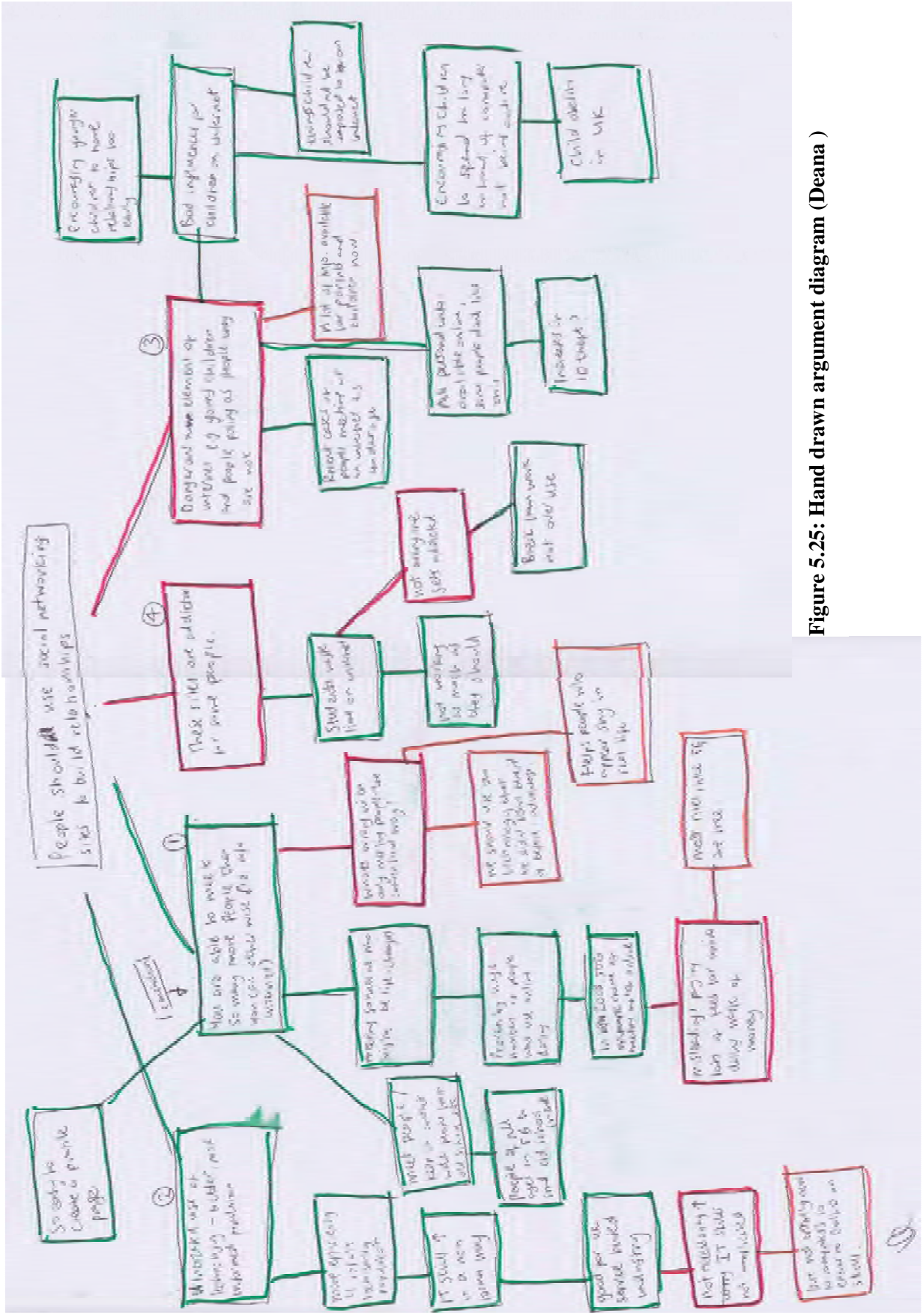


Figure 5.25: Hand drawn argument diagram (Deana)

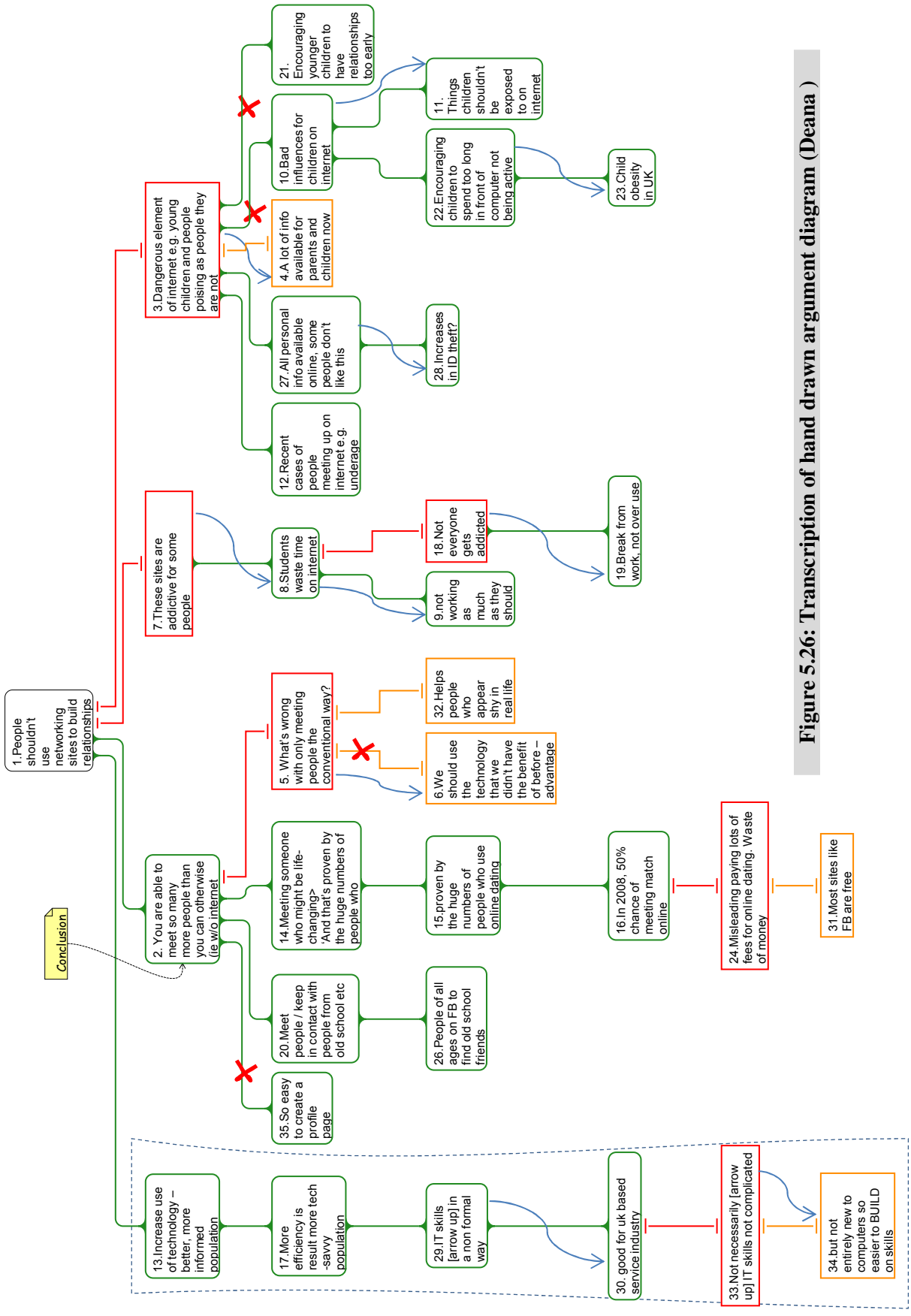


Figure 5.26: Transcription of hand drawn argument diagram (Deana)

Billy's posttest essay retains some of the qualities seen in the baseline essay, for example, the expression of clear position, the clear structure and the relevance of content. However, there are aspects of semantic and rhetorical argument structure that deteriorate.

In Billy's posttest essay, the refutation strategy prevails, while all conciliatory strategies are eliminated. Refutation moves increase considerably, while the total percentage of refuting EDUs reduce, showing that refutation moves are not developed in depth (Table 5.33). The prevailing of refutation strategy and the short refuting moves are attributed to the diagramming and translating process. First, all five sub trees of the diagram include a refutation (Figure 5.27). There are no unrefuted counterarguments. Billy forces himself to counter and refute all supporting arguments. The following is expressed after he developed 4 textboxes in support of his position.

> 'And then I should be opposing or refuting it possibly. How am I going to oppose and refute this? I don't know. I think the argument's good enough by itself, but I need to kind of consider the whole picture so that my arguments are more convincing. I might have to go back to that '

Some of his attempts to counter and refute counterarguments end up as a contrived effort to build up argumentation. For example, the textboxes 8-13 of the sub tree in Table 5.38 (textboxes 8-13). This structure, which was build up consecutively, could have evolved into a weighing strategy or weighing minimization strategy, as was seen in other cases (see for example Pandora in Figure 5.6, p.215). However, the presence of the two red textboxes, the 12 and 13 counterarguments textboxes, urge Billy to refute them (see transcription extract Table 5.39). This is done by adding a rather weak refuting statement (textbox 21). This sub tree is later translated into a paragraph by copying and pasting the content, as it is done for most of the diagram, without elaborating on it (Table 5.38 includes the paragraph and the

copied content in grey highlight). This is representative of Billy's way of integrating the diagram content. This is the reason why the argument moves and in particular the refuting ones are not developed in depth. Billy inserts connecting words trying to integrate the diagram content into paragraphs; however the flow of the text is not as smooth or developed as in his baseline essay.

Applying only the refutation strategy does not raise any concern with Billy. On one hand, he is very happy while he strongly defends his position with refuting counterargument. On the other, he expresses concern over not having expanded the diagram content in the essay.

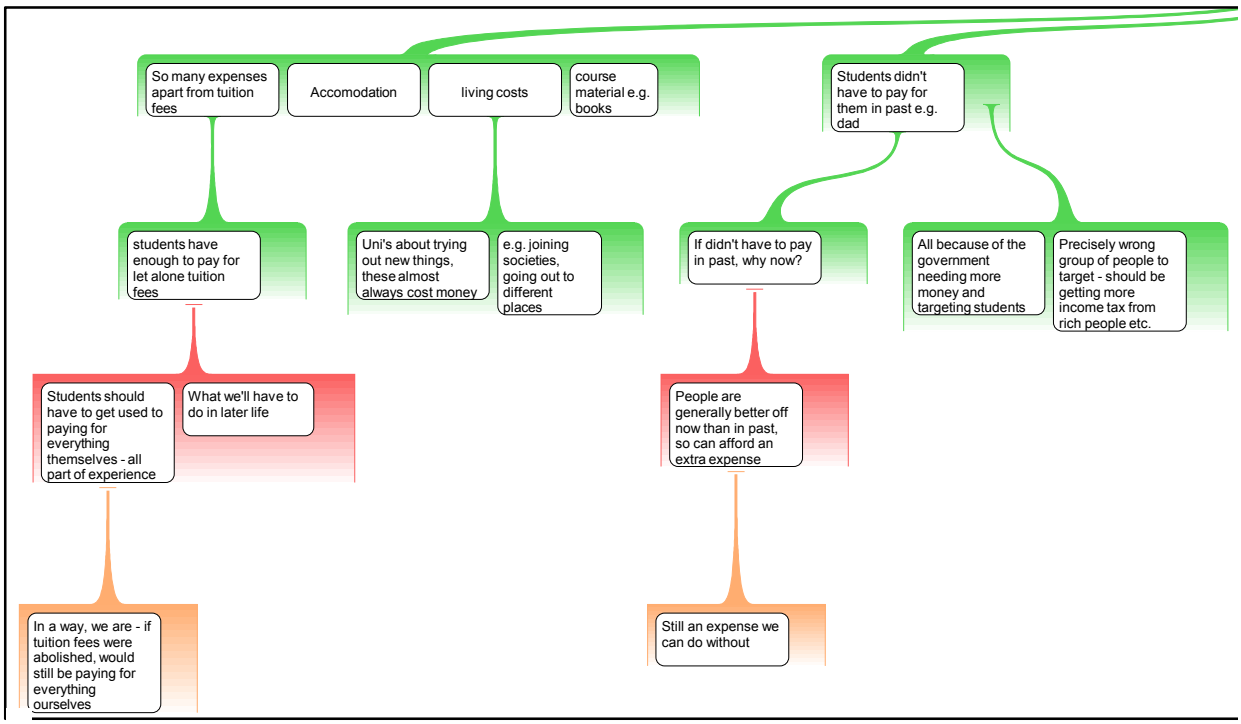
> 'I've actually written less than what I did in the last essay. I've not stringed out things as much in this one. My introduction for a start isn't as long. 64? I can do better than that.'

He does not appear to be concerned with how the way he is expressing his opinion has changed. His conclusion includes only supporting arguments.

Indeed, the second reason that is related to the prevailing of the refutation strategy is the one-sided position that Billy takes from the beginning of the planning. This is consistent with a defensive approach to argumentation (adversary strategy). However, the development of refutation moves in order to defend his position against any possible counterarguments lead to stifling all conciliatory strategies.

Overall, the argument diagramming method is believed to have affected Billy in replacing his familiar weighing and synthesis contingent strategies with the refutation strategy. He diligently followed the guideline to refute all counterarguments. However, he did not reflect on the possibility of using argument diagramming while combining both adversary and conciliatory strategies. This can be attributed to a mechanistic way of adopting a new method of planning without creatively reflecting on how this can enhance the writer's existing

schema. It is thus concluded that Billy did not understood the difference between his own established argument schema and the one he applied with argument diagramming.



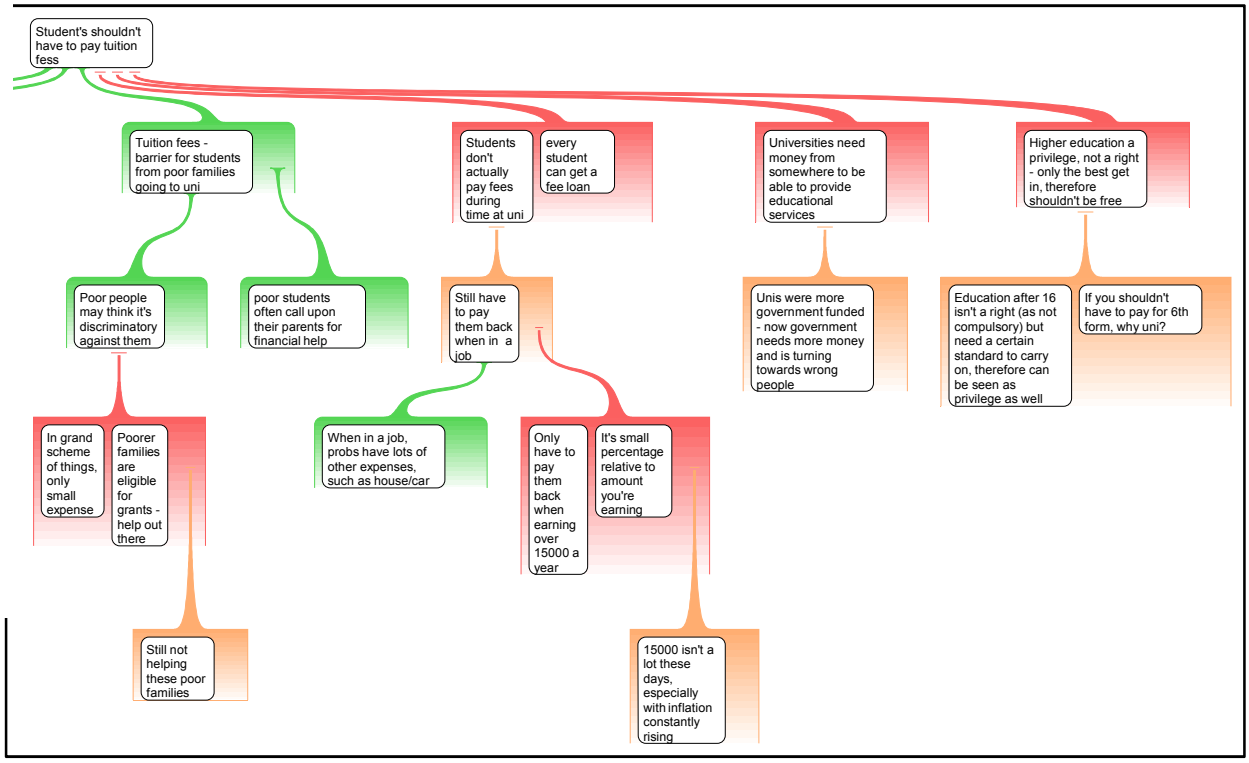
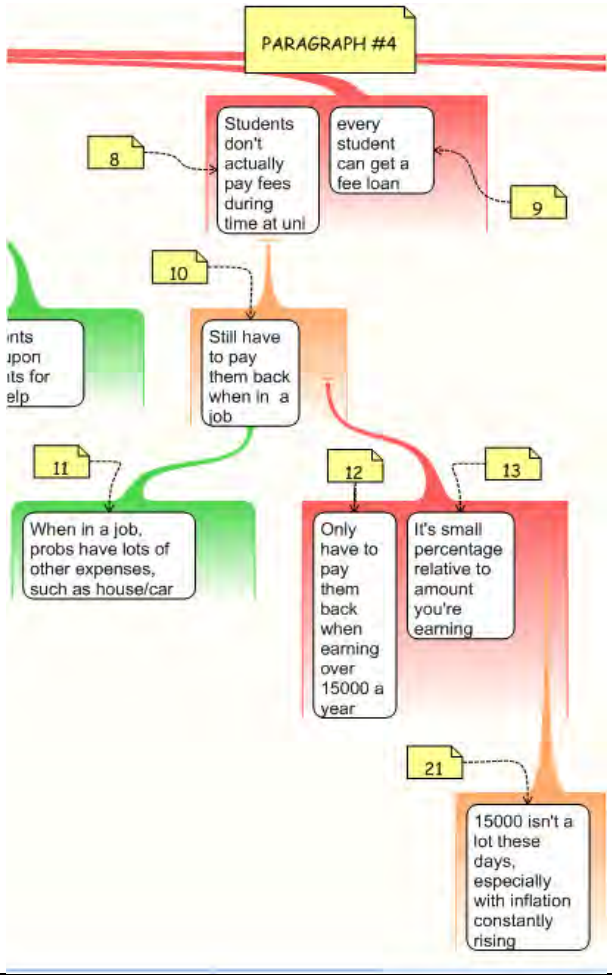


Figure 5.27: Billy's diagram



[Paragraph 4:]

However, it should be pointed out that students don't actually pay their fees during their time at university, seeing as every student can receive a loan to cover such costs. But we still have to pay them back when we have finished our studies and we are in a job. This is not fair at a time when we will probably have lots of other expenses, such as a house and a car. It is true, though, that they only need to be paid back when you are earning over 15,000 a year; coupled with this, it is only a small percentage of your income, relative to the amount you are earning. Going against this, 15,000 a year is not a lot of money these days, especially with inflation constantly on the rise.

Table 5.38: Billy's diagram sub tree and corresponding paragraph

‘So fifteen thousand – it’s not loads is it? I suppose if you’ve got…’ /He reads aloud [C10]/ ‘And then reason to further support this.’ /New textbox (Supports) connected down from [C10]/ ‘When in full-time… no. You still have to pay them back when… in a job. So when in a job, it doesn’t have to be full-time I don’t think.’ /He deletes the words ‘full time’ from [C10]/ [C11] <When in a job, probs have lots of other expenses, such as house/car> ‘Yeah, how to pay back your fees shouldn’t have to kind of impede on your other expenses, although, I suppose, on the other hand, to further oppose this refutation… what was I going to say… You only have to….’ /New textbox (Opposes) connected down from [C10] **but out of view/** ‘…pay them back once you’re earning fifteen thousand or more, and it’s kind of relative to the amount you’re earning, so… God, how am I going to further refute that? I don’t know. Say what I just thought.’ [C12] <Only have to pay them back when earning over 15000 a year> /He reads aloud [C12] as he writes it/ ‘And then also, maybe in the same box…’ /New textbox (Opposes) joined with [C12] but out of view/ ‘It’s relative to the amount you’re earning.’ [C13] <It’s relative to amount you’re earning> ‘This could get quite complicated.’ /He reviews [C13]/ ‘Ok, I need to think of a refutation for that.’ /New textbox (Rebuts) connected down from [C13]/ ‘Yeah, I might have to get back to that.’ *[later on…]*
/He scrolls the computer-diagram to the right and says, ‘So I’ve got two main arguments ‘for’, and one arguments ‘against’….’/ /Pauses; he reviews the right hand side of the diagram/ /He moves the cursor to [C11] and then to [C12] and [C13] and says, ‘Yes, so I need to think of a refutation for that.’/ /He reads aloud [C12] and [C13] respectively/ /Pauses, thinking/ ‘So fifteen thousand, I’d say it’s a small percentage.’ /He adds to [C13]: <small percentage>/ ‘’Cause say like fifteen thousand isn’t a lot, but if it’s a small percentage then it’s not very much anyway.’ /Pauses/ ‘I don’t know. Just say like fifteen thousand isn’t a lot, these days, especially with inflation constantly rising.’ /He starts typing in the Rebuts textbox connected down from [C13] that was created earlier/ [C21] <15000 isn’t a lot these days, especially with inflation constantly rising> ‘Yes.’

Table 5.39: Video transcription extract from Billy's posttest essay

Contrary to Billy, *Liana* retained and increased the adversary and conciliatory strategies in the posttest essay. Although the argument diagram looks similar to Billy's in that most counterarguments are refuted, Liana adopts a weighing and a weighing minimization strategy. For example, the 4th sub tree from the left (consisting of textboxes 7, 14, 15, and 26) in Liana's diagram is translated in the following paragraph:

> *However, social networking can help people meet likeminded individuals so that they can talk to these people about any interests or hobbies that they mutually pursue. They may not have anyone locally that they can do this with and therefore the internet means that they are not as isolated. Online groups can help with this and can often attract vast numbers of people who can all input into discussions. Then again, nowadays there are lots of local activity groups that have been set up to help people share their hobbies. This would mean that they could pursue these interests in reality rather than just talking about them online, and therefore this could combat isolation even more. This way would also enhance peoples everyday lives as well. The internet has the risk that people could neglect acquaintances already in their lives in favour of people they meet online (Paragraph 4# , Liana, posttest essay).*

The paragraph here relates with an antithesis to a previous paragraph in the essay, which developed the supporting argument that 'replacing real life relationships with cyberspace relations is not healthy both physically and mentally'. This paragraph (#4) introduces the advantage of online social networking 'meeting likeminded people' (textbox 7 & 14) as a counterargument to her position (people should not use the internet to build relationships). Then she introduces and develops an advantage, i.e. the advantage of the 'local activity groups', which weighs out the advantage of online networking, but does not annihilate it. The connective 'then again' gives this nuance of contrasting in a moderate way. The last sentence inserts a disadvantage of online social networking (textbox 26) without providing crystal clear markers towards a weighing or a refuting approach. One could say, though, that the word 'could' in the sentence 'The internet has the risk that people *could* neglect acquaintances'

mellows the strength of the statement, hence this is more a weighing strategy. Overall, the intention of the writer in this paragraph is within the frame of a conciliatory strategy rather an adversary.

The question that emerges is why Liana translated this structure as a weighing strategy while Billy did not. The answer should be traced in the rhetorical gaol they set and the underlying schema that motivated this goal. Billy is motivated by a defensive-refutation schema, which is induced by the argument diagramming strategy and not assimilated with familiar conciliatory schemata. This is shown in his one-sided position too. On the other hand, Liana, is motivated by the schema of her synthesis-contingent position to which she concludes. Her conclusion not only refers to arguments developed in the essay (and the diagram) but also defines the condition under which an opposing view (that online social networking can be used to build relationships) hold:

> *To conclude, the internet can often become a substitute for real life and there becomes a problem when this distinction is not recognized. Although it helps to keep in touch with people that you already have an existing relationship with, it does not take the place of true interaction and conversation which develops communication skills greatly. Without this skill a person's development can suffer especially at a young age. When meeting new people the internet has an even greater level of risk as you can never be sure what these people are really like, which introduces great danger when people agree to meet with their online friends. Overall, if the internet is to be used in this way it should be used to compliment other methods of relationship building for friendships that are already established rather as the sole means of communication (Concluding paragraph , Liana, posttest essay).*

Liana appear to have assimilated adversary and conciliatory strategies better than Billy, however there is no evidence in the think aloud protocol to explain this. What *can* be inferred from the process data of Liana is that she applies the argument diagramming method more creatively than Billy and more effectively than Deana.

'Ok, so that's that bit.' \She returns to the diagram\ 'So that was a counter…' \She moves the pen repeatedly between the left and right sides of the diagram\ '…if I move across to a…' \She points the pen at [2]\ 'No actually do another counterargument, 'cause I've got more of them to do still.' \She studies the right side of the diagram for a moment\ \She turns to the computer\ \Starts typing a new (5th) paragraph, reading aloud as she types\ <<One of the major advantages of internet communication is …>>	Before starting paragraph 5
\She deletes the last sentence\ \She turns to the diagram\ 'Now the next point I think. I'm probably going to go back to a supporting argument. Oh actually, I sort of want to finish on a supporting argument so people with disabilities [4].' \She turns back to the computer\ 'Oh that should be running off of that.' \She starts typing a new (7th) paragraph, reading aloud as she types\ <<People with disabilities can sometimes benefit from the internet as it means that they are not isolated from the rest of the world and can still talk to other people [4].>>	Before starting paragraph 7
'Ok.' \She turns briefly to the diagram\ 'And then do this last supporting one. Yep, definitely do the last supporting one.' \She turns back briefly to the diagram\ \She returns to the computer\ \Starts typing a new (eighth) paragraph, reading aloud as she types\ <<The main danger of the internet which makes a strong case against…>>	Before starting paragraph 8

Table 5.40: Extract from video transcript (Liana, posttest essay)

Contrary to Deane, a rationale of how she interacts with the diagram can be traced. She started with introducing the top level textboxes 2-8, i.e. the roots of the 6 sub trees of the diagram (see Figure 5.28and Figure 5.29). She continued with developing the second tree (8-12) then added a couple of textboxes in the middle trees (13, 14 and 15) and then turned her attention to refuting the counterarguments of the right side (16, 17, 18, 19). In the end she developed the tree at the left side of the diagram. The way that Liana constructs her diagram shows that she develops trees in depth and that that she sets clear goals (e.g. refute

counterarguments). There are no irrelevant textboxes and all diagram content is included in the text. This reflective approach to developing the argument diagram also includes theme prioritization and paragraph organization activities. Each time she prepares to start a new paragraph she plans it after reflecting on the diagram. The extract from the video transcript illustrates this point (Table 5.40).

In conclusion, the interaction with argument diagramming of the three participants with similar writing abilities and argumentation schemata revealed three different approaches.

In the case of Deana, the confident but less reflective writer while interacting with argument diagramming, the method failed to improve her integration strategies. Changing her initial schema to integrating arguments and counterarguments outside the conclusion has proven very challenging. In the case of Billy, a competent writer and knowledgeable of adversary and conciliatory strategies, argument diagramming had a limiting impact. Following diligently but mechanistically the instruction limited his opportunity to reflect on how he could combine adversary and conciliatory strategies. Finally, Liana, creatively and efficiently adopted the argument diagramming method allowing her existing schema to be enhanced.

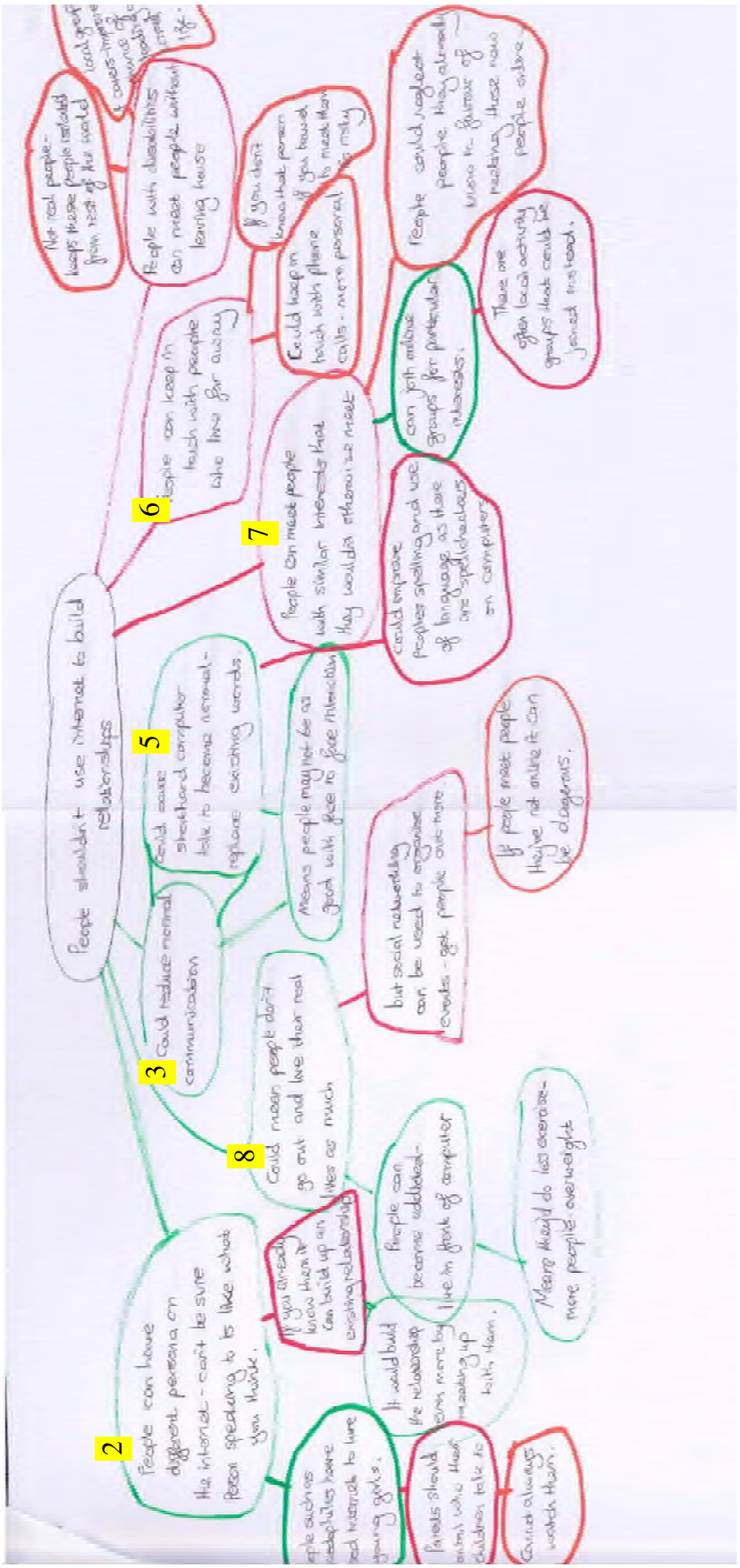


Figure 5.28: Hand drawn argument diagram (Liana)

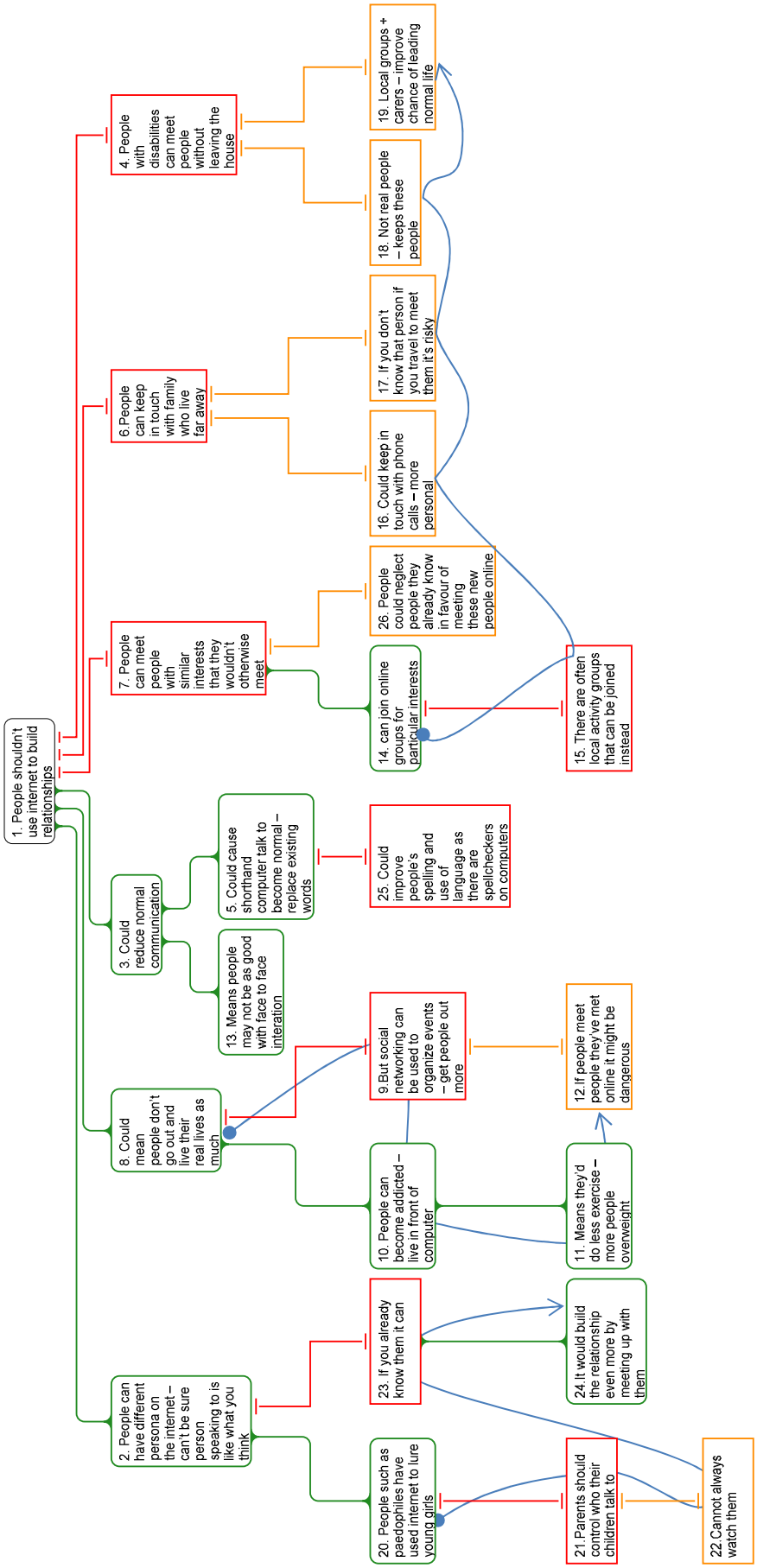


Figure 5.29: Transcription of hand drawn argument diagram (Liana)

Process of baseline essay	
	Billy
1. Type of plan	Rhetorical outline, including parts for Introduction, Main Body and Conclusion,
2. Planning duration	13 minutes of total 2hours
3. Plan entries	28
4. Ideas/argument generation	While preparing rhetorical outline, he first introduces counter-arguments, then weighs up and introduces weighing and synthesis contingent strategies
5. Essay position	Synthesis- contingent position at the beginning of planning, while considering clear position from criteria list item
6. Criteria list	Both guiding and confirming argument moves
7. Reflection on planning	Self-regulating application of argumentation strategies and avoiding of digression
8. Plan to text linearization	Composing follows closely the rhetorical plan. The outline structure is adopted. Points of outline are developed in depth
9. Rhetorical plan	Provides structure of essay parts and refutation, weighing minimization and synthesis contingent strategies
10. Interleaving	Two further points are added during composing
11. Revision	Language revision during composing
Process of posttest essay	
1. Type of plan	a) Rhetorical outline: Short paper-based plan including introduction and conclusion points, b) computer-based diagram
2. Planning duration	Total planning (rhetorical outline & diagram) 42 minutes of total 2 hours.. 5 minutes rhetorical outline and 37 minutes on argument diagramming
3. Plan entries	35 textboxes, 15 support, 12 counter, 8 refutation, 6 trees, 4 max level
4. Diagram content generation	Playing devils' advocate. Most sub trees developed in one go. Some refutation added later on during revisiting counterarguments.
5. Essay position	Early from the begging of planning. Strong belief into one sided position
6. Criteria list	Confirming argument moves
7. Reflection on diagram	Extended focusing on refuting counterarguments and rearranging textboxes
Semantic connectivity of diagram	Very good
8. Diagram to text linearization	Copying and pasting. Following very closely argument diagram structure
9.Rhetorical plan	Outline of introduction and conclusion points. Conclusion points entered after developing argument diagram
10. Interleaving	In the beginning, middle and end of argument diagramming the participant adds points on rhetorical outline. Writing is done without interleaving.
11. Revision	Revision (reading) of essay at the end of composing. Limited language revisions. Limited paragraph re-ordering

Table 5.41: Process measures for Billy during baseline and posttest essays.

Process of baseline essay		
	Liana	**Deana**
1. Type of plan	Spider diagram with supporting, counter and refuting arguments, and conclusion	Outline, including 'positive' and 'negative' points.
2. Planning duration	13 minutes of total 1h 30 minutes	11 minutes of total 1h 15 minutes
3. Plan entries	24 entries	27 entries
4. Ideas/argument generation	Position, counter position on two sides of page. Refutation to counterarguments	Generating 'for' and 'against' points in full sentences
5. Essay position	Deliberated during planning , defined by the end of planning	Deliberating over position during essay writing, established by end of it
6. Criteria list	Confirming	Reads once but does not consider
7. Reflection on planning	Rationale of planning close to argument planning	Brainstorming function rather than organising in dialectical arguments
8. Plan to text linearization	Writing follows closely the plan. Para-graphs organized with numbering entries.	Plan as content reminder.
9. Rhetorical plan	No	No
10. Interleaving	Once to add entry	Twice to add entry.
11. Revision	Reviewing text and revising paragraphs locally	Revising paragraphs during composition. No review in the end
Process of posttest essay		
1. Type of plan	Paper-based argument diagramming	Paper-based argument diagramming
2. Planning duration	18 minutes (out of total 1 hour and 40 minutes)	24 minutes (out of total 1 hour and 30 minutes)
3. Plan entries	26 textboxes: 9 SUP, 8 CNTR, 8 REFT	33 textboxes: 11 SUP, 15 CNTR, 7 REFT
4. Diagram content generation	First, developing top level textboxes on both sides. Then creating sub trees mostly in one go.	Erratic. Impossible to identify rationale. Plan used mainly as brainstorming.
5. Essay position	Defined in the beginning of diagramming. Adjusting to synthesis contingent in the end of essay writing	Deliberating during planning and decided by end of planning.
6. Criteria list	Confirming	Considers once and ticks once each
7. Reflection on diagram	Extensive for organizing paragraphs and theme prioritization	Segmented. Not reading diagram from top to bottom. Missed irrelevant links
Semantic connectivity of diagram	Very good	Very poor
8. Diagram to text linearization	Closely following argument structure	Loosely following diagram structure
9.Rhetorical plan	No	No
10. Interleaving	Once to add entry to diagram	No
11. Revision	Revises quite extensively	Revises very limitedly at the end. Reviews whole essay once.

Table 5.42: Process measures for Liana and Deana during baseline and posttest essays

5.9.5 Comparison of the Integration group

There is little evidence to believe that the differences in the interactive behaviour with argument diagramming are related with the paper or computer medium.

Deana and Liana, who used the method on paper, had different behaviour and results. The neatly arranged diagram of Deana (Figure 5.25) was not better than Liana's (Figure 5.26) in terms of coherence and context. In fact it was shown that Liana followed a much clearer rationale in constructing her diagram.

A point that is worth noting is that Billy, who applied the method on computer, incorporated a paper-based plan prior to starting his computer-based plan. He returns to it a few times to add notes while interacting with the computer diagram. At times he seems to be preparing to add a note on paper but he diligently returns to the computer diagram. However, he also appears to appreciate the function of the computer-based diagram.

/He adds to [C29], reading aloud: <poor students often call upon their parents for financial help>/
'And then shall I just leave that hanging?'
/Pauses/
'No I think that should go more there, I think.'
/He indicates [C23] with the cursor/
/New textbox (Supports) connected down from [C23]/
/He cuts what he has just added to [C29] and pastes it in the new textbox connected down from [C23] to become [C30]/
'It's a good tool, 'cause you kind of organize your arguments more, and it's kind of easier to develop them, less messy than writing them on paper.

In Billy's case at least, paper and computer media are complementing each other.

5.9.6 Concluding remarks for the Integration group

In this group, the negative effects of argument diagramming become even bigger. Deteriorations occur in a number of areas and they definitely outweigh the benefits that the

method induces (Table 5.43). In general writers are ‘coerced’ into refutation, retracting into adversarial strategies, one-sided positions, contrived refutations, argument statements of lower depth and shorter argument moves. The argument diagramming tool is used in most of the cases mechanistically, more as a set of ‘must-do’ instructions rather than an opportunity to reflect, learn and advance. Instrumental in this negative cycle is that the argument diagram notation falls short in expressing the more sophisticated needs and requirements of these writers by constraining them into expressing adversary strategies. Those who are less willing or unable to identify this limitation engage in practicing the refutation strategy but engage awkwardly and silently. One participant is actually wondering, in the think-aloud protocol, how the method works and “how they are going to do it?” One of the participants manages to combine both methods but reduces the integration of conciliatory strategies. Limited interleaving between translating and planning, limited revisions and limited paragraph re-ordering complement the picture of a rather restricted effect. The diagram platform, paper or computer does not differentiate the impact.

As for the rhetorical effects, the tool shows similar results as in the last group where it prompts an erratic planning. In one case the method has damaged an exemplar thematic flow, prompting an interrupted flow and the use of poor connectives and arguments of low depth. In another case, the automatic functionality is used to translate the plan into an outline, without any elaboration or reflection from the part of the writer (see Figure 6.3, p.353 for an illustration of the automatic outline).

Exception to this pattern is the weaker writer of this group, who used the method in a very reflective way, learning how to introduce weighing which is based on deep refutations and more “mellow” statements. The regular pause for reflection, the setting of clear writing goals and the use of the tool for organising paragraphs are processes that his writer engaged in.

Semantic changes	Associated Processes		ArgD
Position becomes less integrative and one-sided	Adopts one-sided position at the beginning of argument diagramming	PL	PC
	The position is not challenged during writing - no interleaving between essay and argument diagram	INTER	PC
Retraction to adversarial strategies such as refutation without weighing	Writer force himself to counter or refute all arguments – development of refutation mechanistically	PL	PC
	Weak links between textboxes	PL	Paper
Introduce weighing strategy based on deep refutations and more 'mellow' statements	Every time she starts a new tree (i.e. paragraph) in the argument diagram, she stops to reflect	PL	Paper
Argument statements become of lower depth and with shorter argument moves	Writer never read or review the sub tress of argument diagram, reducing considerably the pauses to reflect (compared to baseline)	PL	Paper
	Argument diagram trees are translated into essay paragraphs without any elaboration (copy & paste)	INTER	PC
Doubles deep refutation	Develop argument diagram trees in depth	PL	Paper
	Writer stops to reflect at the beginning of each tree in argument diagramming	PL	Paper
Rhetorical changes	**Associated Processes**		**ArgD**
Thematic flow shifts from exemplar (in baseline) to interrupted with rather weak connecting arguments	Argument diagram trees are translated into essay paragraphs without any elaboration (copy & paste)	INTER	PC
	Limited revisions in writing	WR	PC
	Limited paragraphs re-ordering	WR	PC
Much better thematic flow, paragraphs relate either thematically or by orientation	Writer engages in theme prioritization while engaging with argument diagramming	PL	Paper
	Writer engages in paragraph organization activities while engaging with argument diagramming	PL	Paper
Juxtaposition increases	Very erratic planning in argument diagramming, shifting from one side of the diagram to another	PL	Paper
	Weak textbox links	PL	Paper
	Pauses to reflect reduced compared to baseline	PL	Paper
Irrelevant content increases	Very erratic planning in argument diagramming, shifting from one side of the diagram to another before completing a tree	PL	Paper
	Writing of essay is finished without revising	WR	Paper
Unclear passages eliminated	Set clear goals for each tree in the argument diagramming	PL	Paper
	Writer stops to reflect at the beginning of each tree in argument diagramming	PL	Paper

PL = Planning, LN = Linearization, Inter = Interleaving, WR = Writing
Green cells = improvement compared to baseline; Red cells = deterioration compared to baseline

Table 5.43: Text changes and associated processes in posttest essay in the Integration group

5.10 Conclusions

This chapter has discussed the analysis of results received through an experiment which was designed as a qualitative research project. Sixteen undergraduate students were asked to undertake a realistic writing task, while the research captured (video, audio and screen recordings) data on the process of planning and writing an argumentative essay. The subjects were asked to carry out the writing task two times, once without the assistance of argument diagramming and once with the support of an argument diagramming method. The reviewed evidence revealed a variety of change trajectories, combining different combinations of semantic and rhetorical changes in the text as the result of using the argument diagramming method (Figure 5.30). The occurred changes were analysed and discussed, taking into account the argumentation schema of the participants, as identified in the baseline essay.

Participants with the lowest ability in argumentative writing, namely those identified with my side bias schema, have gained a lot out of the argument diagramming method. The argument diagramming method has enabled them to spend more time on planning, become familiar with the use of counter and refutation arguments in writing and reflect more on the links between different arguments. In the main, their essays became richer in semantic content, like the amount of counter and refutation arguments included in the text and the quality of refutation statements, although still in a framework of my side bias approach. They also gained a lot in rhetorical terms by reducing digressions, repetitions and unclear statements.

Participants at the low level of pseudo-integration schema also gained a lot. The argument diagramming method allowed them to spend more time on inventing content at the first stage of planning, deliberate on the significance of supporting and counter arguments and impose more structure on a usually erratic linearization process. As a result their essays demonstrated rhetorical gains like the development of more depth in the developed statements. The most important gains were noticed in semantic terms with essays increasing the amount of counter

and refuting arguments, including more weighing and weighing minimization and handling complex argumentation structures much better. These gains enabled them to progress in a more advanced argumentation position, the high level of pseudo-integration.

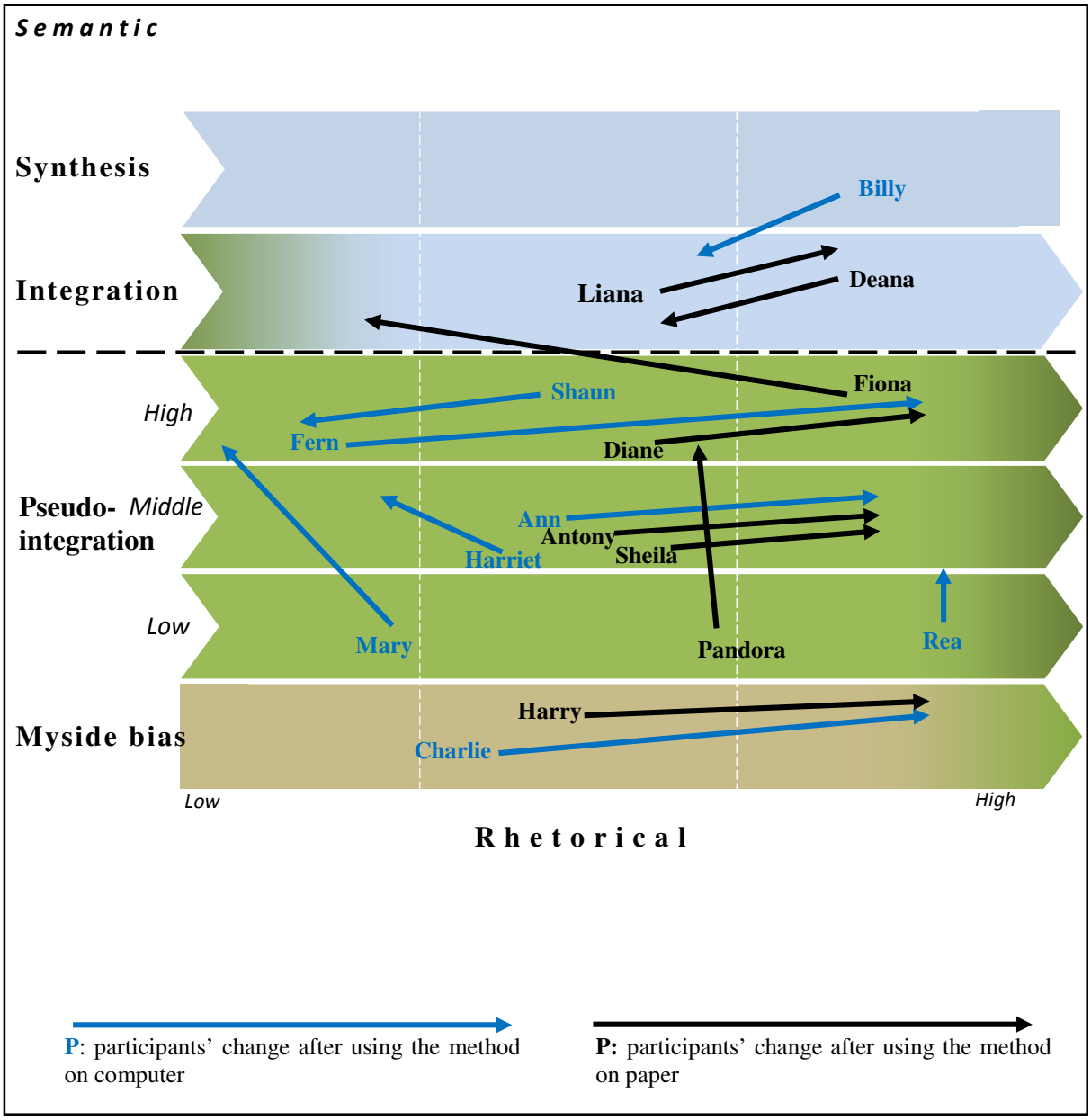


Figure 5.30: Change of argumentative text for participants in Study 2

Participants at a middle level of pseudo-integration used the argument diagramming method to check if newly invented arguments fit the overall position of the essay, analyse the overall position of the essay and formulate a position in planning rather in writing. As a result, their

essays move away from hinted, unclear and ‘one-sided’ positions to positions with a qualification or with a ‘synthesis-contingent’ approach (conditional positions depending on the set of circumstances). In terms of rhetorical gains, they managed to improve the relevance of their arguments and avoid the juxtaposition problem when they weigh opposing arguments.

The study has shown much more limited impact on the higher ends of argumentation ability, namely writers at the high end of pseudo-integration and writers with an integration/synthesis schema. The main gains from the method at these levels were the increase and the deepening of refutation and the improvement of thematic continuity and the relevance of the content. The main processes involved in these advances were the extended time on reflection during planning and the use of more sophisticated functions (especially in the software version of the tool), i.e. the argument evaluation functionality. However the method has a rather distracting effect to several writers from this group who experienced retraction to more adversarial strategies, less sophisticated positions and shorter and less deep statements.

No significant difference was found with regards to the medium of argument diagramming paper or computer-based. Participants with lower or higher benefits were found in both paper-based and computer-based groups. The most noticeable difference was found in terms of the usability of the two versions of the method. The computer-based method allowed an easier rearrangement of textboxes and statements, gave the writers more space to expand (in depth or in width) and in general they were easier to build. The linearization of the diagram could be done in two ways: from memory, switching between the text editor and the diagram window, by coping the diagram and pasting it as an outline (automatic outline), in parts or as a whole. The more reflective writers favoured the former way, transforming and elaborating the content while editing the diagram content. Those who applied the automatic outline, without expanding on the pasted content, composed essays that included juxtapositions, short argument moves and in generally text that did not flow well.

On the other hand, the paper-based method is more interactive and allows the simultaneous viewing of the plan and the developing essay, a critical help during the linearization process. It also allows the easy annotation with informal notations, such circling or crossing out diagram components. The disadvantages is that they can end up as messy sketches of argument diagram and they make difficult to overview the balance between arguments of opposing directions as well as the links between them.

The advantages and disadvantages of argument diagramming are related properties of the notation (Blackwell et al., 2001; Green, 1989). Argument diagramming provides procedural support for position deliberation and position analysis. The visibility of the diagram components, e.g. colour and textbox associations, allow to effectively overview the balance of arguments and the coherence between arguments and position. However, the diagram notation does not to express more sophisticated positions, such as the synthesis contingent. The argument diagram conveys the adversary strategies as the most salient argumentation strategies while the conciliatory strategies can become salient mainly when a position deliberation approach is taken. The role expressiveness of diagram tree formation supports the linearization and the organization of subtrees in paragraphs. However, both the computer- and the paper-based are viscous and decline in role expressiveness when it comes to accommodate a revised position.

Chapter 6 Study 2: Interviews

Chapter 3 and chapter 5 investigated the impact of argument diagramming on text, in particular, the investigation focused on the quality of essays written after argument diagramming was employed as a pre-writing strategy on paper or on computer. Chapter 5 also investigated how changes in argumentative writing process relate to change in quality of argumentative writing as result of using argument diagramming. In this chapter the investigation turns to the *writers' metacognitive awareness* about the processes and strategies involved in planning, linearizing and writing. The chapter reports on the change of *writers' metacognitive awareness* as results of using argument diagramming.

Hence, this chapter deals with the 3rd research question of this thesis *"What is the impact of argument diagramming on metacognitive awareness about argumentative writing?"* Using the argument diagramming method on paper and on computer is also considered in order to define whether advantages or challenges of one or the other medium affect differently the writer's awareness about the formulation of argumentation structure.

The theoretical consideration that motivated this were presented earlier in Chapter 2 (Section 2.4).The method of deducing concept categories that emerged from the interview analysis is presented in Section 6.1. The conceptual framework that was defined on the basis of concept categories is presented in the following sections. Sections 6.3-6.6 present the 16 participants in 4 groups according to their argumentation schema at baseline, on the basis of the analysis of the first interview. In each section the change in awareness after the posttest essay are also presented. Differences in perceiving the impact of diagramming between computer and paper users are discussed in each section.

6.1 Analysis methodology of awareness about argumentative process

Study 2 also investigates how argument diagramming impacts the writer's metacognitive awareness about process and strategies. This is the writer's own perspective. The importance of writer's metacognition about the argumentative genre is well established and the importance of metacognitive awareness is gaining ground in the writing research (Harris et al., 2010) .However, very few studies investigate how changing the writing practices and process impacts the writer's metacognition about these practices and process (Conner, 2007; Igland, 2009).

6.1.1 Grounded theory and constant comparative method

The constant comparative method, a method used by the grounded theory approach, was used for the qualitative analysis of the interviews. Comparison is a predominant analysis process in many qualitative analysis approaches and an important tool in grounded theory (Boeije, 2002; Corbin & Strauss, 1990; Glaser & Strauss, 1967). Constant comparison is important in developing a theory that is grounded on data. Linda Flower (1989) proposed grounded theory as part of the observational research context, suggesting that writing research needs a "vision that is grounded in specific knowledge about real people writing" (p.283).

After completing composing their essay, each of the 16 participants was interviewed (see section 4.2.10 p. 125 for interview questions). The baseline and argument diagramming interviews, approximately 16 hours in total, were transcribed verbatim and consecutively analysed employing the constant comparative method while engaging in coding, categorizing, defining categories, and connecting categories. The transcripts were examined line by line and codes were assigned at the margin of the transcripts.

The analyst embarked on the analysis and coding of interviews before analysing the essays and process data. This ensured that the analyst had no preconception about the quality of argumentative essays and the writing process of the participants. For this reason the interview analysis took place first, followed by the essay and then process analysis Thus the perspective taken in the analysis was the participant's own perspective. The investigation into writer's awareness is the least explored; in fact, there are no studies – at least to the knowledge of the writer- investigating accounts of writers before and after using a similar argument diagramming method. Starting with the least possible preconceptions is an advantage in qualitative analysis, especially when adopting methods such as grounded theory.

The aim of the analysis was to summarise the participants' accounts of argumentative writing process, their knowledge about the strategies they usually employ, their thoughts about their own difficulties with argumentative writing, and how using the diagram method affected their thoughts and knowledge after the argument diagramming phase.

Analysing interview transcripts required many types of comparison not only within a single interview (within the baseline interviews and within the posttest interviews), but also a comparison between the baseline and posttest interview to explore changes. The process of analysis followed 6 steps (A-F), which are outlined in Table 6.1 and Table 6.2. While the first 3 steps (A-C) yielded different codes and categories between the baseline and posttest categories, the last 3 steps (D-F) generated common categories that unified the data:

A. Initially coding took place within a single interview (open coding), then codes were compared with codes emerging from other participants' interviews, firstly within the baseline interviews, then to posttest interviews. Next the codes were compared between baseline and posttest interviews. *Open or initial coding* aims to initiate an open-ended review of the data, fragment qualitative data into distinct parts, compare them for

similarities or differences, and, in this case, identify the core themes of the interview (Strauss & Corbin, 1990)

B. *Focused coding* is applied on coded data in order to organize them in fitting categories without being concerned about the properties or dimensions of the categories (Charmaz, 2006; Saldaña, 2009). The outcome of this coding is a set of sub categories.

C. Through *axial coding*, comparisons within interviews and between baseline and posttest interviews, elicited overarching categories. New data from the interviews were constantly compared with existing codes and categories, which resulted to semantically organising related categories (Strauss & Corbin, 1990).

D. Further axial coding yielded a set of categories (Table 6.1 and Table 6.2) that unify all interview data under 3 concept categories (knowledge of ability, knowledge of schema and strategies, implementation and evaluation).

E. The 3 concept categories underpin the development of the conceptual framework, which refers to the core category, argumentation schema. In particular the conceptual framework refers to the dimensions of the argumentation schema, representation of argumentation schema and awareness of argumentation schema.

F. After the core category and its dimensions emerged a literature review on argumentation schemata corroborated the representation of argumentation schema through a typology of 4 incremental levels (myside bias, pseudo-integration, integration and synthesis). Another typology of 3 incremental levels (unaware, aware-but-lost, aware-and-oriented) emerged from the analysis of the interview and defined the second dimension of the core category, awareness of argumentation schema. The elementary and core categories are presented in detail in Chapter 8.

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th></tr>
<tr><td rowspan="3">Open coding</td><td rowspan="2">Sub categories</td><td rowspan="2">Categories</td><td rowspan="2">Concept categories</td><td>Core category dimensions</td><td>Typology of dimensions</td></tr>
<tr><td colspan="2">Conceptual framework</td></tr>
<tr><td>Focused coding</td><td>Axial coding</td><td>Axial coding</td><td>Theoretical coding</td><td>Axial coding</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Elaborate planning strategies
Cursory planning strategies
Linearization strategy
Position formulating
Underrating counter argumentation
Valuing counter argumentation</td><td>Knowledge about writing strategies</td><td rowspan="2">Knowledge of schema and strategies</td><td rowspan="3">Representation of argumentation schema</td><td rowspan="2">Synthesis
Integration
Pseudo-integration
Myside bias</td></tr>
<tr><td>Knowledge about argumentation formulation</td></tr>
<tr><td></td><td>Essay structure
Irrelevant to argumentation formulation
Position formulation
Argumentation formulation
Argument orientation
Genre requirements</td><td>Difficulties with argumentative writing</td><td>Knowledge of ability</td><td rowspan="2">Awareness of argumentation schema</td><td rowspan="2">Unaware
Aware-but-lost
Aware-and-oriented</td></tr>
<tr><td></td><td>Unclear goal setting
Flawed goal setting
Lack of self-regulation skills</td><td>Implementation & evaluation</td><td>Implementation & evaluation</td></tr>
</table>

Table 6.1: Data analysis steps: code and categories from baseline interviews

<table>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td></tr>
<tr><td rowspan="3">Open coding</td><td rowspan="2">Sub categories</td><td rowspan="2">Categories</td><td rowspan="2">Concept categories</td><td>Core category dimensions</td><td>Typology of dimensions</td></tr>
<tr><td colspan="2">Conceptual framework</td></tr>
<tr><td>Focused coding</td><td>Axial coding</td><td>Axial coding</td><td>Theoretical coding</td><td>Axial coding</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Planning process enhanced with argumentation goals
Linearization process supported by argument formulation processes</td><td>Knowledge about writing strategies enhanced with argumentation goals</td><td rowspan="2">Knowledge of schema and strategies</td><td rowspan="3">Representation of argumentation schema</td><td rowspan="2">Synthesis
Integration
Pseudo-integration
Myside bias</td></tr>
<tr><td></td><td>Through comparison with previous practice
As result of engaging with diagram</td><td>Developed knowledge about formulation</td></tr>
<tr><td></td><td>Irrelevant to argument formulation
Position formulation
Argumentation formulation
Argument orientation
Genre requirements
Cognitive load from method learning</td><td>Difficulties with argumentative writing</td><td>Knowledge of ability</td><td>Awareness of argumentation schema</td><td>Unaware
Aware-but-lost
Aware-and-oriented</td></tr>
<tr><td></td><td>Perceived advantages of diagramming method
Perceived disadvantages of diagramming method
Perceived impact on quality of text
Challenges
Flawed goal setting</td><td>Implementation & evaluation</td><td>Implementation & evaluation</td><td></td><td></td></tr>
</table>

Table 6.2: Data analysis steps: code and categories from posttest interviews

6.2 Concept Categories

Each of the following tables shows how identified phenomena were labelled with codes and categories contributing to the emergence of the core category, argumentation schema. The three main concept categories, *knowledge of schema and strategies, knowledge of ability,* and *implementation and evaluation of strategies* are presented here showing how they relate to subcategories and the core category.

Previously in this chapter schemata are defined as knowledge that guide the formulation of argumentation structure (Kintsch, 1974), and mental representations that encompass goals and strategies for invention and organisation of argumentation (Anderson et al., 2001). The concept of ***'Knowledge of schema and strategies'*** encapsulates in this analysis two main categories: 'Knowledge about writing strategies' and 'knowledge about argumentation formulation' (see column C of Table 6.1 and Table 6.2). These two categories emerged from the analysis showing that participants expressed their knowledge about writing strategies (Table 6.4) separately to how argumentation is formulated (Table 6.6) in the baseline interviews. Thus a clear distinction is possible between knowledge about writing strategies and knowledge about argument formulation in the participants' first interview. 'Position formulating' and the approach towards counter argumentation, i.e. 'underrating' or 'valuing counter argumentation', are central in how participants perceived argumentation formulation in the baseline interview (Table 6.6). For example, including and refuting counterarguments is not important in argumentative essays, according to some participants. An interesting finding is observed in comparison to posttest interviews. The participants integrate in their accounts of writing strategies aspects of argumentation formulation, namely they perceive planning and linearizing processes to be enhanced with argument formulation goals (Table 6.5). For example, participants refer to how visualising the orientation of arguments with colour helped them to review the balance between supporting and counter arguments and thus helped them

to reflect on their position before starting writing the essay. The separate categorisation, 'knowledge about writing strategies' and 'knowledge about argument formulation' could not be applied in the posttest interviews analysis. This could support an assertion that using the diagramming method allowed participants to come to the realisation that argumentation formulation is possible to be integrated in the planning and linearizing stages. Furthermore, examining the categories 'position formulating' and 'underrating, and 'valuing' counterarguments (Table 6.6) elicited three dimensions that are important in defining the representation of argumentation schema and the adopted typology (myside bias, pseudo-integration, integration and synthesis): position formulating, inclusion of counterarguments, and argument-counterargument integration (Table 6.10). These dimensions conceptualise a spectrum of argumentation schemata. On one side of the spectrum, the writer's argumentation schema motivates him or her to rely on existing beliefs, support them in earnest, and deter from including opposing views for fear that counterarguments weaken his or her position. On the other side, the argumentation schema motivate the writer to expose existing beliefs to criticism and formulate his or her position after taking opposing views into consideration and integrating supporting and countering arguments.

'Knowledge of ability' refers to strength and difficulties perceived with reference to argumentative writing. The strength or difficulties may refer to past experiences or current ones relating to the study writing tasks. The term 'ability' was decided in order to encapsulate both strengths and difficulties, although strengths are discussed by fewer participants. The term 'ability' relates to declarative knowledge, i.e. to knowledge one may have about his or her abilities, or about strategies that may be considered as part of strengths and limitations (McCormick, 2003). In this analysis, knowledge of ability is mainly understood through the category *'difficulties with argumentative writing'* (Table 6.3), which is further characterised as: difficulties that are relevant to argumentation formulation issues (i.e. position formulation,

argumentation formulation, argument orientation, argumentative genre requirements), difficulties that are irrelevant, e.g. difficulty with handwriting, or difficulties that would apply to any writing task, e.g. difficulty with structure. The differentiation of difficulties between relevant and irrelevant to argumentation formulation inform the awareness of argumentation schema dimension: 'Unaware' participants, as opposed to 'aware', refer to 'irrelevant' difficulties, do not realise the limitations of the schema they use, neither they sense a need to improve it.

Furthermore, it is important to note that after comparing the reports on difficulties 3 possibilities emerged: a) new difficulties were reported in the posttest, b) most or all of the difficulties reported in the baseline interview remained in the posttest interview, and c) previous difficulties were overcome. This comparison introduced an important aspect in participants' change of awareness: that change in perception about argumentative difficulties varies amongst participants.

'Knowledge of ability' and 'knowledge of schema and strategies' change and possibly progress from pre- to posttest, based on the analyst's comparison. However, a significant comparison is done by the participants themselves, who realise that, in comparison to previous practice, they were not adopting certain argument formulation goals or strategies (sub category 'through comparison with previous practice' Table 6.7). For example, a participant observed after using the diagramming method that supporting arguments and counterarguments are integrated and that in her posttest essay he does not present them in separate paragraphs as he used to do.

Codes	Sub-categories	Pre	Post	Properties
Digression from topic	Essay structure	√		Difficulties irrelevant to argumentation formulation
Unclear structure				
Repetition				
Handwriting	Irrelevant to argumentation formulation	√	√	
Obsessing over micro-revisions				
Time constraints restricting idea development				
Taking a clear position in the debate	Position formulation	√	√	Difficulties relevant to argumentation formulation
Deliberating over position				
Anticipating opposing view				
Integrating multiple views				
Developing points in depth	Argumentation formulation	√	√	
Inventing counterarguments				
Refuting counterarguments				
Unclear argumentation structure				
Integrating arguments and counterarguments in same paragraph				
Integrating developed argumentation in conclusion				
Position reflecting arguments' balance	Argument orientation	√	√	
Weighing up argument counterarguments				
Prioritising arguments				
Backing up statements with references/ evidence/examples	Argumentative genre requirements	√	√	
A-level 'sitting on the fence' approach				
Learning burden / necessary learning curve	Cognitive load from method learning		√	Difficulties related to using the method (paper and pc)
Changing usual method planning				
Adapting to usual method of planning				

Table 6.3: Difficulties with argumentative writing: codes and categories from analysis of pre- and posttest interviews

Codes from analysis of baseline interviews	Sub categories	Categories
Semantic planning (e.g. spider plans, semantic map)	Elaborate planning strategies	Knowledge about writing strategies
Rhetorical planning (e.g. numbered lists, outlines)		
Mainly semantic followed by rhetorical		
Formulating structure through extensive revising		
Interleaving, returning to planning to review position		
Extensive planning is in general considered beneficial to writing	Cursory planning strategies	
Informal random list		
Carless and rusher writing		
Limited planning		
Thematic criteria guiding linearization	Linearization strategy	
Lack or unclear linearization strategy		
Introduction, positives, negatives		
Prioritizing based on argument strength		

Table 6.4: Knowledge about writing strategies: codes and categories from analysis of baseline interviews

Codes from analysis of posttest interviews	Sub-categories	Categories
Planning goals taken into consideration:	Planning process enhanced with argument formulation goals	Knowledge about writing strategies enhanced with argumentation formulation goals
argument orientation and balance		
argument statements association		
argument strength evaluation		
Diagram contributes to:	Linearization process supported by argument formulation processes	
Text organisation following argument orientation or strength		
coherent paragraphing		
emergence of main arguments themes		
Including content relevant to position		

Table 6.5: Knowledge about writing strategies: codes and categories from analysis of posttest interviews

Codes from analysis of baseline interviews	Sub categories	Categories
Weighing arguments to formulate position	Position formulating	Knowledge about argumentation formulation
Avoiding expression of opinion		
Formulating and maintaining position throughout text		
Refuting counterarguments not necessary	Underrating counter argumentation	
Confusion about what refutation is		
Counterarguments weaken position		
Defending position with supporting arguments and modest counter argumentation		
Counterarguments are taken into account	Valuing counter argumentation	
Anticipating equally position and opposition		
Supporting arguments and counterarguments are integrated		
Counterarguments are refuted		

Table 6.6: Knowledge about argumentation formulation: codes and categories from analysis of baseline interviews

Codes from analysis of posttest interviews	Sub-categories	Categories
After comparing with previous practice, identified lack in:	Through comparison with previous practice	Developed knowledge about argumentation formulation
refuting counterarguments		
Integrating supporting arguments with counterarguments		
semantic to rhetorical structure transformations		
consolidating supporting and countering arguments in position formulation		
cognitive load management during writing		
developing ideas in depth		
developing text around a position		
Interacting with diagram contributes to:	As result of engaging with diagram	
Position formulation		
Externalizing thinking process		
invention of counterarguments		
refutation of counterarguments		
invention &organization of ideas		

Table 6.7: Knowledge about argumentation formulation: codes and categories from analysis of posttest interviews

Codes from analysis of baseline interviews	Sub-categories	Categories
Confusing accounts of argumentation process	Unclear goal setting (without participant realizing)	Implementation & Evaluation
Uncertainty about meaning or value of refutation		
Genre contraints définie argumentation formulation		
Defending position with supporting arguments and modest counter argumentation	Flawed goal setting (without participant realizing)	
Persuasiveness depends on strong beliefs		
Over concerned about invention of counterarguments (rather than integration)		
Lack of information organising skills	Lack of self-regulation skills	
Unable to monitor balance of position		

Table 6.8: Implementation and evaluation of knowledge about schemata and strategies: codes and categories from analysis of baseline interviews

Codes from analysis of posttest interviews	Sub-categories	Categories
Visualization of argumentation structure	Perceived advantages of diagramming method	Implementation & Evaluation
Diagram being easy to update alienates cognitive load (PC)		
overview of plan (paper)		
Strength evaluation feature (PC)		
automatic outline (PC)	Perceived disadvantages of diagramming method	
increased time on planning (PC)		
diagram to outline conversion (PC)		
manipulating diagram on screen (PC)		
constraining argument representation to one notation only (not suitable for less formal planning)		
Impact of increased argumentation complexity on clarity of argumentation	Perceived impact on quality of text	
clearer position expressed		
improved text coherence		
deeper development of ideas		
advanced strategies introduced new difficulties	Challenges	
goal setting contradicting method principles		
usual strategies equally effective		
Persuasiveness depends on strong beliefs	Flawed goal setting	
Refuting counterarguments is not important		

Table 6.9: Implementation and evaluation of knowledge about schemata and strategies: codes and categories from analysis of posttest interviews

Knowledge of ability		
	Aware of argumentative writing difficulties that are:	
Irrelevant to argumentation formulation	⟷	Relevant to argumentation formulation
	Improvement awareness:	
Non critical or over confident about current strategies	⟷	Feeling the need to improve current strategies
Knowledge of argumentation schema and strategies		
	Position formulating:	
Based on 'my side bias'	⟷	Based on evaluation and integration of opposing views
	Inclusion of counterarguments:	
Excluding counterarguments because they weaken position	⟷	Valuing counterarguments and refuting them to strengthen position
	Argument-counterargument integration:	
Defending position with supporting arguments and including modest counterarguments separately	⟷	Counterarguments are outweighed by supporting ones or refuted by rebuttals

Table 6.10: Dimension of metacognition concepts

The participants' own observation that their practice differ or improves from previous practice is a reflection of the **implementation** of schema and strategies. Furthermore, when participants report about their strategies, cases of 'unclear' or 'flawed goal setting', 'lack of required skills' and other 'challenges' emerge (Table 6.8 and Table 6.9). Additionally, all participants evaluate the diagram method and report about advantages and disadvantages how these affected their final text (Table 6.9). Both the computer-based and paper-based methods were equally praised for supporting the planning process. However, the computer-based method received most criticism, in particular the automatic outline feature, and the manipulation of the diagram on screen.

Argumentation schemata have been used throughout this thesis to describe an aspect of argumentative writing ability. They encompass knowledge that the writer retrieves when engaging in specific goals, processes and strategies of writing. The following 4 sections, 6.3 - 6.6, present the 16 participants in 4 groups according to their argumentation schema at baseline, on the basis of the analysis of the first interview. In each section the shifts of the participants after the posttest essay are also presented.

6.3 Myside bias argumentation schema

In the MSB schema counterarguments or opposing views are not taken into account. Less skilled arguers often find difficult to invent counterarguments especially if they strongly hold a position. Novice writers may think of counterarguments during planning but still avoid including them in writing.

6.3.1 MSB as initial schema

The argumentation schema of Charlie, Harry, Rea and Pandora is the myside bias (MSB) argumentation schema. This section reports that these four participants are aware of the limitation of the MSB schemas but differ in how aware they are. Charlie and Harry are aware-but-lost, while Rea and Pandora are aware-and-oriented. None of the four is categorised as unaware, because in the first interview, none appears confident that excluding counterarguments is a good practice. This section reports that the aware-but-lost differ from the aware-and-oriented in two points. First, the aware-and-oriented participants, Rea and Pandora (Table 6.11) appreciate the cause or impact of their strategies on the quality of argumentation while the aware-but-lost do not (Table 6.12). Secondly, the aware-and-oriented are more familiar than the aware-but-lost about the processes required by a more advanced than the MSB schema. The aware-but-lost are aware of difficulties but not of its cause or

impact. They also know that they should include opposing views or counterarguments but do not know how.

Characteristics of MSB: aware-and-oriented (based on analysis of interview PRE)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Aware of cause or impact of difficulties on argumentative writing	**Aware of integration principles but lacking in relevant planning and organising strategies**	**Flawed goal setting or monitoring in argumentative writing**
Rea	Integrating supporting argumentation and counter argumentation in the same paragraph is confusing. Difficulty with points and arguments presented in a muddled and unclear structure. Integrating developed points in conclusion feels like repeating them.	Presenting evenly supporting and counterarguments is better (schema) than defending position with supporting arguments and modest counter argumentation. Invent arguments with two column list and points as they come to mind.	Believing strongly in a position makes argumentation more persuasive. Lack of information organisation skill.
Pandora	Being strongly biased towards a point of view prevents from anticipating opposing views. Weakness: unclear argumentation, repetitions, weak conclusions.	Effort to match counterarguments to supporting arguments is made. Confusion about what refutation is	The main concern is in inventing arguments rather than integrating them in the text

Table 6.11: MSB aware-and-oriented as initial schema

Regarding the first point, the aware-and-oriented participants, Rea and Pandora, discuss their difficulties and criticize some of their current strategies (Table 6.11, 1st column). Pandora has difficulty with inventing counterarguments but makes a critical observation. She sees that being strongly biased towards a point of view prevents her from anticipating the opposing view.

> Interviewer: How do you find the process of arguing for and against?
> Pandora: It depends on the topic because some are more difficult than others. Sometimes I find it difficult, like when I have my mind stuck on one point of view, I find it difficult to find opposing views. I am not very good at showing both sides of the argument.

Rea observes that she does not develop the supporting and opposing arguments adequately and, as a consequence, her argumentation structure is unclear.

> Rea: Is not clear enough structure, like I haven't done a reason for and then explained it properly. I have kind of written why I think and then carried on with a similar point that merged it with another and then gone onto against and done the same thing rather than doing it clearly, I think.
> Interviewer: Could you please explain this?
> Rea: I would like to have had my 'for' point for and written a point and explained why and backed it up. And then written another or however many, then changed to against and done the same thing, so it's clear why is 'for' and why is 'against'.

Both Rea and Pandora articulate the strategies they consider problematic. They also know that these strategies have negative impact on their writing.

Conversely, the aware-but-lost participants refer to difficulties or weakness they have with argumentative writing but they do not realise how these weaknesses may affect their writing. Charlie and Harry, the two aware-but-lost participants, simply describe the difficulty of inventing counterarguments (Table 6.12, 1st column). Charlie reports that he would like to include more counterarguments in his essays but he finds it difficult. Harry is only just starting to doubt about his practice of not including counterarguments.

> Sometimes I don't give the counterarguments, you just want to say what you think, and ignore the counterarguments, I don't know. But you need to include other ideas, don't you? (Harry)

The aware-but-lost participants sense that it is difficult to implement the strategies required by a more advanced schema (Table 6.12). The aware-and-oriented discuss the limitations and the impact of their strategies in a more reasoned manner (Table 6.11).

Characteristics of MSB: aware-but-lost (based on analysis of interview PRE)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Aware of difficulties but unaware of their impact on argumentative writing	**Appreciation of strategies general to writing rather than particular to argumentative writing**	**Unclear or flawed goal setting in argumentative writing**
Charlie	Difficulty with invention of counterarguments. Difficulty with developing points in depth. Difficulty with digression	Acknowledges benefit of formulating structure prior to writing. Extensive planning is beneficial to writing outcome.	(Planning process of counter argumentation reported in a confusing manner.)
Harry	Not including counterarguments is perhaps a bad practice.	Extensive planning is beneficial to writing outcome.	Presenting supporting arguments and separately a few counterarguments during task.

Table 6.12: MSB aware-but-lost as initial schema

A second point that differentiates the aware-and-oriented from the aware-but-lost is that the latter participants, Charlie and Harry, appreciate the value of writing strategies in a broad and general way without referring to strategies of argumentative writing. They mention, for example, that formulating the structure of the text during planning is an advantage and planning for longer benefits the quality of writing (Table 6.12, 2nd column). On the other

hand, Rea and Pandora's understanding is more advanced and more specific to the requirements of argumentative writing. The aware-and-oriented, Rea and Pandora, seem to be more familiar with how to integrate supporting arguments and counterarguments in the writing process, even if at times they find it difficult (Table 6.11, 2nd column): Rea tries to be less biased by presenting both sides 'more evenly' while she would usually defend her position with a majority of supporting arguments and very few counter arguments. She thinks the former is more effective.

> You have to write the other side of the argument, but in this one I more did it evenly and then said my own opinion whereas normally, but this is, normally I would say everything that I think that why it's right and then say a little bit about why I think that's wrong. It's better to do it more evenly I think (Rea).

Pandora reports that she is trying to match counterarguments to supporting arguments while she writes her text. Charlie and Harry differ from Rea and Pandora in that their knowledge on how to integrate counterarguments in their writing is less sound (Table 6.12, 3rd column). For example, Charlie's account of how to integrate arguments and counterarguments is unclear when it comes to implementing their strategies

> Interviewer: So, while you were planning which of these [in the criteria list] you think it was more difficult to tick?
> Charlie: Probably the counter argument. Because I sort-of included them in the 'for' ones when I was saying 'this is why it is for and it can't be any other way because', so I was trying to explain the counter arguments, it was like repeating it.

Harry reports that he presented supporting arguments and separately few counterarguments, which is not an integration strategy.

A final point is that, although Rea and Pandora are more knowledgeable of integration principles, they find them difficult to implement. For example, integrating arguments and counterarguments in the same paragraph is confusing for Rea. This difficulty is possible to be related to her limitation in organizing ideas in a clear structure (Table 6.11).

> Interviewer: And perhaps a weakness when you are write argumentative essays?

> Rea: I don't know. I don't know if I am clear enough with how I deal with my points. They kind of, I think some of them, like when I am writing I think suddenly, I have to put that in and they kind of roll into one rather than making clear points and then argument another point, and then argument another point, and then argument, it kind of just goes into one thing, which is not very clear for the reader I don't think.

While both Pandora and Rea have a better understanding of the processes required by a more advanced argumentation schema, in practice, they do not set consistent to these processes goals (Table 6.11, 3rd column). Rea reports that a better practice would be to present 'evenly' arguments and counterarguments but this is difficult to achieve with the strategy of inventing points randomly in a 'for and against list'. Pandora is aware of her weaknesses, i.e. the unclear argumentation, the repetitions, and weak conclusions but she does not mention ways for coping with these. She gives a simple account of idea invention during planning followed by a writing phase. Content invention seems to be the main concern rather than the integration of planning ideas in writing.

> Interviewer: Ok. If you could compare the planning and the writing phases, which one do you find more difficult?
> Pandora: Probably the planning phase because that's when I come up with ideas, and writing is just putting it in all into words which I find quite easy.

In summary, after comparing the two pairs it is argued that the aware-and-oriented are more aware of the reasons why they should progress to a more advanced schema. They are also more knowledgeable of the strategies involved in argumentative writing than the aware-but-lost.

Characteristics of minor shift: from MSB aware-but-lost to MSB aware-and-oriented			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Similar difficulties reported as before, defined with reference to advanced argumentation schema **Aware of cause or impact of difficulties**	**Gain in knowledge about strategies that are specific to argumentation**	**Increased ability in diagnosing problems and evaluating outcome** **Lack in strategies for coping with complexity**
Charlie	Less difficulty with invention of counterarguments thanks to diagramming.	Aware of lack of semantic planning in pre Arguments and counterarguments are matched during planning and then integrated in one paragraph rather than in separate ones.	Concerned with clarity of argumentation Increased complexity of structure causes concern regarding clarity of argumentation
Harry	Including counterarguments and refutation may constraint personal opinion. Finds it difficult to take a 'direct line of thought' because of integration of supporting and countering arguments	Diagramming improves text flow by linking ideas together	Unsure whether linking points together with diagramming would contribute to better text 'style' Although integration was easy on plan, linearization presented great difficulty with clearly presented own position, and presenting different views

Table 6.13: Minor MSB shift, from aware-but-lost to aware-and-oriented

6.3.2 Minor MSB shifts in argumentation schema awareness

A minor shift is observed in how the two aware-but-lost participants, Charlie and Harry, change their awareness of argumentation schema after they are introduced to the strategy of argument diagramming. This shift is characterized mainly by a gain in knowledge about planning the structure of argumentation, namely introducing sub processes, such as the integration process of matching arguments to counterarguments during planning. Such planning sub processes increase the complexity of the task and heighten the demands during linearizing and linguistic encoding. This minor shift, including the knowledge gain and the emerging need for advanced encoding, promotes Charlie and Harry to the aware-and-oriented category (Table 6.13).However, these two are considered to remain in the same argumentation schema, the MSB, because they refer to similar difficulties regarding argumentative writing as before, albeit with a lesser strength. This minor shift is presented here on the basis of the three components that define the level of awareness.

First, from the point of view of knowledge of ability there is little change. In their initial interview Harry and Charlie appear aware of the difficulties and are motivated to change their argumentation schema. However, the difficulties they report after using the method (Table 6.13, 1st column) remain the same as before (Table 6.12). In the post interview, Charlie still experiences difficulty with invention of counterarguments, although it appears to be at a lesser degree. Harry is still unsure about the advanced schema. He is concerned that including counterarguments and refutation constraints his personal opinion from being conveyed in the text.

Second, Charlie and Harry do not report about writing in a generic way, as they did in their initial interview. They now give accounts of processes that include counter argumentation, semantic planning, ideas association, and linearization (Table 6.13, 2nd column). Harry

concludes that diagramming improves text flow by linking ideas together. Similarly, Charlie realises that before he did not plan his ideas in a structured way.

> It's just that I was able to structure. Before I just wrote, just the starting one [referring to initial bullet points in pre essay] then after I do it as I went along. Whereas this [the post essay], I already structured what I was going to do, linked my ideas together, while that [the pre essay] was straight away rather than try and plan it (Charlie).

Thirdly, argument diagrammatic appears to increase knowledge about the planning and linearizing process but at the same time increases the cognitive demands for implementing these processes. Both Charlie and Harry realise that the argument structure is more complex in their post essay (Table 6.13, 3rd column). They have to convey this structure in writing when linearizing the content of the diagram in the text. This appears to be an additional difficulty that they did not face before using the diagramming method. Dealing with more advanced structures and processes may stimulate their awareness about the difficulties of more advanced and complex schemata. However, they may be able to monitor this complexity but they have not the strategies or skills for resolving it.

6.3.3 Major MSB shifts in argumentation schema awareness

The two aware-and-oriented participants, Rea and Pandora improve from the MSB argumentation schema to the pseudo-integration schema. In the second interview, the participants overcome most of their difficulties and limitations reported in first interview. They report about new goals and difficulties that relate to a more advanced than the MSB schema, the pseudo-integration schema (Table 6.14, 1st column). The two participants improve towards adopting some principles of the integration schema but are still lacking in knowledge of integration process and strategies. In pseudo-integration, counter argumentation is included but without impact on the deliberation of the position. The author's position agrees

with the side he or she feels strongly and avoids the rationale of a reasoned position or conclusion.

In their second interview, the participants Rea and Pandora describe argumentative strategies that counter most difficulties and criticisms of the initial interview (Table 6.14 , 2nd column). They both compare the new process, introduced with diagramming, with the old ones and identify the benefits. Rea reports that diagramming helps her to structure her paragraphs and overcome the confusion caused by integrating supporting and countering arguments in the same paragraph:

> Advantage is that it looks much clearer and that you can actually plan each paragraph with a tree and have 'for' and 'against' in the same section rather than it all being muddled up. (Rea)

Similar to Rea, Pandora is also dealing with the difficulties mentioned in the first interview, such as unclear argumentation and weak conclusions. In the quotes below Pandora appears to be trying to back up arguments and to improve her conclusion.

> Pandora: Well it was difficult (to use the diagram) at the beginning but then when I got used to it, it was slightly easy because I could link all the points down. Because before I was just coming up with random points, that didn't link to each other.
> Interviewer: In the beginning of planning today you mean?
> Pandora: No, the last essay with random points that didn't join to each other.
> Interviewer: But did you say you found it easier to use it towards the end of the session today?
> Pandora: Yes, because I was starting to get where I was supposed to be putting the points that would link to each other and like help me to make the arguments stronger, because in my last essay I kind of made an argument and then didn't really back it up as much as I did today.

When Pandora is asked about her conclusion in the second essay she justifies why she thinks it has improved.

> Interviewer: What do you think about your conclusion today?
> Pandora: I thought it was a bit short. But it makes the point that I wanted to make, so I don't think it's too hard.
> Interviewer: What was hard about it?
> Pandora I have the impression that I need to include all the information I have put in the rest of the essay into a small paragraph. And I quite often think that I haven't put in

> everything that I included in the essay. I don't know if that weakens the conclusion. This conclusion reflects most of the content. I don't think it reflects all of it. But the most important points that were made and some of the refutations were included, so I think that my final position was quite clear.

Thus, Pandora discussed that the formulation of her position, which is included in the conclusion, should draw on points developed in the essay.

Characteristics of major shift: from MSB aware-and-oriented to Pseudo-integration aware-but-lost			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	New difficulties and course of action to deal with reported	Appreciation of diagramming strategy in coping with previously (PRE) mentioned integration difficulties	Flawed goal setting regarding argumentation processes Lack in strategies for coping with complexity
Rea	Unsure about developing points in depth; further details or examples may be needed in her essay.	Diagramming contributes to change of paragraph structure In post arguments are matched while they were not in pre Diagramming makes thinking process transparent Starts to include counterarguments more, and visualize orientation	Position taking relies on position she feels strongly about Increased complexity of structure raises clarity issue
Pandora	Refutation included in planning but not in writing	Clearer position and conclusion thanks to clearer argumentation and sensible points Points being easily linked together contribute to better flow Shifting away from randomly inventing points to well structure points	Including refutation in the text is not considered important

Table 6.14: Major MSB shift, from MSB aware-and-oriented to Pseudo integration aware-but-lost

Furthermore, Rea and Pandora compare with previous practices and identify quite important changes that relate to argument diagramming. Pandora identifies a knowledge telling strategy and realises how diagramming helps her to organise her argumentation.

> Interviewer: Ok, so overall did you find that it was comfortable to use that (argument diagramming method)?
> Pandora: I found it a lot easier when I was writing my essay. I thought it made me put more effort into the planning than I would have done before. When I did the spider diagram, I just generally jotted down any notes that came to my head, but now I had to put them into an order, but it made the writing a lot easy, because I could just go down this path now, and go to the end of this path. Just made it really fast. […] Last time I made all my points but they didn't link to each other; when I was writing my essay I was picking up each point individually, not really following in kind of each way, just tromping about.

Rea comments about how diagramming makes her thinking process more accessible and transparent so she can follow her train of thought. The use of colour prompts her to invent more counterarguments and visualise the orientation of arguments (Table 6.14, 2nd column)

Both Rea and Pandora are becoming aware of the benefits of the diagramming process on their practice. They are now more aware of the process of integration. However they have not overcome certain misconceptions. Rea takes her position on a sentimental basis rather than as result of a reasoning process. Pandora reports that including refutation of counterarguments does not strengthen the position.

6.3.4 Differences between computer and paper users in perceiving the impact of diagramming

Harry and Charlie give accounts of complex processes in their post interview. These refer to linearization, formulation of paragraphs and how argument-counterargument integration affects the formulation of their position. However, Harry -working on paper- and Charlie -on computer- provide different perspectives about linearization (Table 6.13, 2nd column). In particular, Charlie seems to be more comfortable to deal with the macrostructure of

argumentation, while Harry with microstructure. Conversely, Harry seems to encounter greater difficulty with issues related to macrostructure, such as position taking.

Charlie seems to be guided by the structure of the computer diagram when he linearizes and reflects on the diagram for defining the structure of paragraphs.

> Interviewer: Ok. And then, if you remember, how was this diagram turned into this essay?
> Charlie: I've copied each little branch and then integrating these into one paragraph. For that larger one (branch) I made two separate paragraphs and the rest I use normally one (branch) for the short paragraph

Charlie copies and pastes from the computer diagram and this, according to him, helps him to organise the text in paragraphs. Harry, on the other hand, appears to be concerned with the linearization process and worries whether his opinion is clearly expressed after integrating supporting and opposing arguments.

> Yeah I quite like it [the argument diagramming] I can see myself using it. Yeah to be honest I would use it again. It is easy to make the essay flow, because you have all the points linked and flow which feels good but I find it hard to take a direct line...a direct line of thought… constantly integrating points…I may not be clear what I write I find it very easy to integrate it [he points to diagram branches and then pointing to the sequences of counterarguments and refutations on diagram] but I am afraid it may not clear what I am thinking what my personal opinion is. Because you keep saying 'however', 'but' all that…(Harry)

Harry finds it difficult to take a 'direct line of thought', he is not confident with 'constantly integrating points' in the text. He is preoccupied about whether his position is expressed.

Charlie, too, finds it different and more difficult than usual to integrate supporting and opposing arguments in the same paragraph, but does not worry about his position, instead he is concerned about how clear his argumentation is. Contrary, Harry praises the paper-based method for easily linking points together and making the essay flow. In summary, Harry is less confident about expressing a position but more confident about the local relations between ideas after using the diagram on paper. Charlie is more confident about forming paragraphs but less confident about the clarity of argumentation as result of putting together

arguments and counterarguments. Harry seems to be more comfortable with microstructure while working on paper. Position formulation and structuring paragraphs, namely macrostructure aspects, are of less concern for Charlie, on computer. In this case, working on computer seems to favour the macrostructure and working on paper the microstructure.

Interestingly, Rea and Pandora's accounts include a parallel differentiation. Rea, who edits the diagram on computer, thinks that diagramming contributes to change of paragraph structure, helps to visualise orientation of arguments, and makes the thinking process transparent. Pandora, on the other hand, who works on paper, thinks that points being easily linked together contribute to a better flowing text (Table 6.14, 2nd column).

A minor and major shift is observed in the MSB category. Charlie and Harry's reports include some gain in knowledge of planning process, argumentation strategies and in awareness of difficulties deriving from more complex structure. Although they are able to diagnose the problems that emerge from more complex structures they are not able to resolve it. Their persisting difficulty with essential integration strategies of argumentation, such as the invention of counterarguments and formulating of own position through argument integration indicates that the MSB schema is still influential on them.

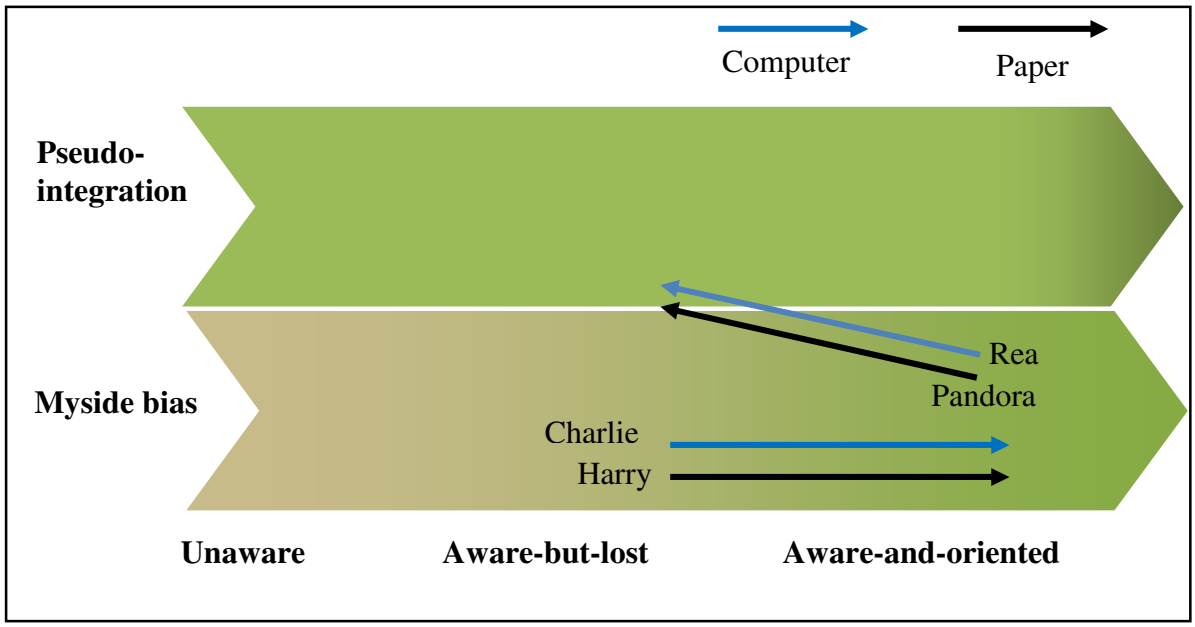


Figure 6.1: Minor and major meta-cognitive shifts in Myside bias group

To sum up, Rea and Pandora appreciate diagramming as an argumentation strategy that helped with overcoming existing difficulties. Through diagramming they are introduced to integration strategies but their understanding of argumentation schema does not improve as far as revising certain misconceptions, such as that position is formulated on an emotional basis and that refuting counterarguments is not important. So they improve to pseudo-integration but not to a more advanced schema.

6.4 Pseudo-integration schema

In the pseudo-integration schema counterarguments, and often refutation, are taken into account but without affecting the formulation of position. Nine out of 16 participants are categorised under the pseudo-integration schema on the basis of their first interview and the self-reported perception about argumentative writing strategies and rhetorical goals. In other studies too pseudo-integration is reported as predominant strategy amongst undergraduate students (Nussbaum, 2008; Nussbaum et al., 2007).

The current section defines the level of awareness of the 9 participants about their argumentation schema, before and after being introduced to the diagram method, i.e. unaware, aware-but-lost and aware-and-oriented. This definition includes, as in the previous section, their perceived motive and control over improving their practice to a more advanced schema, i.e. the integration schema, before and after using the method. More crucially the section reports on the perceived effectiveness of the diagramming method as a strategy of integration.

The 9 participants, who report about pseudo-integration strategies in their first interview, differ in three points:

- how aware they are about the limitations of pseudo-integration (knowledge of ability) -
- how knowledgeable they are about the integration process (knowledge of schema and strategies)

- and how they manage integration processes and cope with difficulties encountered (implementation of schema and strategies)

Based on these three points the 9 participants are grouped under the three levels:

Unaware: Fern, Shaun, and Ann refer to pseudo-integration strategies without realising the limitations of the schema.

Aware-but-lost: Mary, Sheila and Antony are more aware of the limitations of pseudo-integration strategies, they refer to some integration strategies but consider them difficult to implement.

Aware-and-oriented: Harriet, Fiona and Diane are fully aware of the limitations of pseudo-integration and more knowledgeable about integration strategies than the participants of lower levels.

6.4.1 Pseudo-integration and unaware as initial schema

Fern, Shaun and Ann's perception of argumentation schema is categorised under the pseudo-integration schema and more specifically in the unaware category. The 3 participants criticize very little their argumentative writing practices. When asked about their difficulties and weaknesses in argumentative writing they refer to issues that are not relevant to argumentative processes (Table 6.15, 1st column). They include counterarguments and alternative positions in their essays but their strategies do not encourage the formulation of position through the process of integrating supporting arguments with counterarguments. Effectively, they report about pseudo-integration strategies, but without realizing the limitations of these (Table 6.15, 2nd and 3rd column).

A characteristic of the unaware category is that participants reflect much less on the appropriateness of strategies. In particular, when the three participants reflect on their

Characteristics of Pseudo-integration: unaware (based on analysis of interview PRE)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Difficulties and limitations reported do not refer to argumentative processes	**Reference to pseudo-integration schema and strategies**	**Goal setting consistent with pseudo-integration** **Knowledge of integration strategies but not implementing them**
Fern	Handwriting is time consuming. Obsession with revising at micro level and producing many drafts.	Text structure: Introduction, positives negatives conclusion Prioritises stronger arguments first to support position Refutation prevails in debate not in text	Aware of refutation strategy but not implementing it Rhetorical mental planning
Shaun	Difficulty with inferring key points is attributed to distraction by details. Difficulty with formulation of position is attributed to restricted time on task	Text structure: Introduction, positives negatives conclusion Takes opposing view into consideration but considers unacceptable to refute someone's opposing opinion	Personal opinion should not be expressed Aware of refutation strategy but not implementing it Limited or no planning
Ann	Difficulty with being distracted and digressing from essay question.	Positives, negatives, middle ground position, the usual schema. Strength: Ability to take a 'middle ground position'	Difficulty with structure and making text flow is managed with revision and use of connective words Taking a clear stand in a debate is not usually a requirement of argumentative essays. Mental planning mainly

Table 6.15: Pseudo-integration and unaware as initial schema

difficulties, they refer to issues that are irrelevant to argumentative processes (Table 6.15, 1st column). Shaun attributes his difficulty to formulate a position to practical constraints such as limited time on task. Fern is referring to handwriting as one of her main difficulties with argumentative writing.

Ann expresses the most relevant concern when she refers to getting easily distracted:

> What's my weaknesses? I get distracted easily. Sometimes I lose track of what the question is asking and I go off on tangents which isn't good (Ann)

The three participants share the same rhetorical schema in structuring their text, presenting, first, an introduction, then, paragraphs supporting the position followed by paragraphs opposing the position, and finally conclusion (Table 6.15, 2nd column). It is typical of the pseudo-integration schema that the conclusion or the position does not rely on the argument-counterargument integration. The writer concludes without addressing already raised counterarguments, which may be either ignored or silenced. Fern starts the development of her argumentation with the strongest supporting argument, and then moves on to less strong and then to arguments she does not agree with. It is not clear how Fern deals with the counterarguments in her conclusion but she reports that she believes that refuting counterarguments does not strengthen her position. Ann is also following the positive-negatives-conclusion structure and insists on always taking a middle ground position.

> Interviewer: Ok so when you were writing argumentatively what was your strength you think?
> Ann: My strength was usually in, we were taught an essay format in my school, you write, the good bit, the bad bit, and then your point of view which is usually in the middle, so my, I was usually quite good at not having to commit to either one of the good or the bad, that sort of commit to a generalised sort of statement that was like that, which is not actually suggesting that I support either, but rather than saying this is my opinion and I think this and it relates but it doesn't actually mean very much in terms of question.
> Interviewer: Ok, so you were advised not to clearly say what you believe.
> Ann: No, we were I suppose to, but I didn't like actively agreeing or disagreeing, I liked having my own opinion that was neither agree or disagree.

Insisting on always adopting a middle ground position does not involve integration of supporting and countering arguments in order to support the position. There may be cases where, upon reflection, a strong position can be supported. The third participant, Shaun, provides clearer evidence about omitting such a reflection process. He gives little attention to organizing the relations between arguments and counterarguments, and is oblivious to refuting counterarguments.

> Shaun: Because I didn't think I would have enough time to actually write, so I just kind of tried to put, tried to formulate some things in my mind. Just I've basically said I was gonna do introduction and then why is good, why social network sites are good for relationships, and then why they are not, and then a conclusion but then go back and then counter, and then put counter arguments between each points.
> Interviewer: So your goal was to include all these points?
> Shaun: Yeah, just an introduction, I always feel it's good to leave something to the text. And then yeah, then talked about the positive and the negative, then the conclusion, but just realised I haven't done actually, I counter argued the good part but I forgot to in the bad. But I don't think that will be too much of a problem.

Shaun appears to provide counterarguments to position but does not refute counterarguments. There is little evidence to support that either of the participants formulates a position after integrating supporting and opposing arguments. None of the participants considers the limitations of their current strategies, such as not refuting counterarguments.

Clearly Fern and Shaun consider that refuting counter-arguments is not an appropriate strategy, despite being familiar with it from university activities. Shaun is aware of what refutation is from a philosophy course; however, he thinks that as a writer he should not refute someone else's position. Fern believes that refutation is useful and meaningful in oral debate, such as is in her debate club, but not so much in text.

> Not sure, I think with the debate you have to bring in the counter-arguments a lot more, so you definitely have to say, someone will say this but someone will say this, whereas I think in essays you bring it [the counterarguments] in a little less (Fern).

Both participants know what refutation is about, in that they have some experience of it as a generic argumentation strategy, but choose not to activate it in writing (Table 6.15, 3rd column).

Regarding their approach to planning it is important to bear in mind that Shaun does limited or no planning, while Fern and Ann adopt more systematically planning and revising strategies. Fern adopts a rather elaborate planning strategy: she uses a rhetorical plan for mentally planning her essay where she prioritizes her arguments by strength; she produces more than one versions of an outline; she also revises extensively. Ann is also planning her essay mentally and fine tunes her ideas while revising; she focuses a lot on using connective words in consecutive rounds of revision in order to establish a logical flow to the text. Shaun, on the other hand, finds planning potentially useful but difficult; he is abstract and rather unaware about how to plan.

> Shaun: I think I should plan more in my essays and so it's something I need to work on.
> Interviewer: Why do you think you should plan more?
> Shaun: It's well, I kind of think, I think my writing is good but I don't think that -like I have known- that just writing does not make a good essay, you know, it's about the structure. It's about your arguments. And that you can write the best way in the world but it doesn't mean your essay is gonna be good. So that' what it needs, and then planning works on the structure, doesn't it?

Overall, in terms of regulating their cognition about their writing process the three participants do not reflect much on the appropriateness of their practice, with Ann being the most reflective of the three. Shaun adopts the least elaborate planning strategy. Currently there is little evidence indicating that their strategies support integration of arguments and counterarguments. There is little awareness about needing to improve their way of composing augmentative writing or changing their planning strategy.

6.4.2 Minor progress vs. no progress in awareness of the pseudo-integration schema

The three participants, Fern, Shaun and Ann, do not improve their awareness in the same way although they are all applying the diagram method on computer (Figure 6.2).

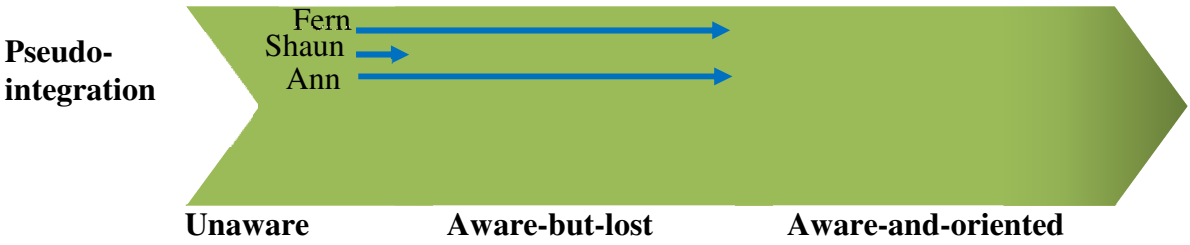


Figure 6.2: Change in awareness from pseudo-integration unaware

Fern and Ann report improvement in awareness of argumentative processes and strategies while Shaun reports no change in awareness and is sceptical about the value of the method (Table 6.16 and Table 6.17).

Fern and Ann gain knowledge of integration strategies, especially the significance of refuting counterarguments (Table 6.16, 2nd column). They also criticize the rhetorical strategies they have been using previously, contrasting them with the practice of the computer-supported diagram method. Fern realises that in her first essay she was implementing a strategy of emphasizing the supporting arguments and minimizing the counterarguments and simply attaching a conclusion in the end. In other words, she becomes aware of applying a pseudo-integration strategy and is critical of it. She also sees the benefit of refutation in establishing well-linked ideas.

> Interviewer: Overall did you learn anything from using this method?
> Fern: I did learn more about how important it is to oppose and that it's not a bad thing, so bring in the opposition more, because I felt with my last essay it was more like I am right I am right I am right and then a bit of I'm wrong, but in this one I wrote in paragraphs, I was sort of arguing that and then bringing in an opposition and then refuting it, whereas before I would have written everything and then brought in the end, but I think this is better, because it is linked.

Minor pseudo-integration shift: from unaware to aware-and-oriented			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Aware of cause of difficulties	**Gain in knowledge of integration principles** **Appreciation of diagramming strategies with reference to previously (PRE) mentioned difficulties or other requirements.**	**Ability in monitoring and evaluating planning and linearizing strategies.**
Fern	She has difficulty with counterarguments because she strongly believes in position	Acknowledges the role of refuting counterarguments to strengthen argumentation Assigning strengths to arguments useful in selecting relevant content. (Weighting as integration strategy). Acknowledges that her second essay is more integrated. However, it is not mentioned that her position is formed on integrated arguments.	Diagram more effective in planning rather than linearizing. The automatic outline function is heavily criticised. Very supportive of the need to rewrite and transform diagram content between planning and writing stages. Would keep elements of diagramming planning to her own planning practice
Ann	Initially concerned about clarity of argumentation but later on reassured	Refutation acknowledged as a valid integration strategy Diagramming helped to take a stronger position and to be less indecisive about position Taking a clear position is considered to improve flow of essay, make writing easier	Easier retrieval of ideas and cognitive load management during writing. Easily updated diagram does not disrupt train of thought during writing. Defining argument orientation of textboxes difficult at times but useful

Table 6.16: Minor Pseudo-integration shift, from unaware to aware-and-oriented

In her first interview, Fern contested whether refuting counterarguments is a valid rhetorical strategy in argumentative writing. In her second, she becomes aware that refuting counterarguments makes her argumentation much stronger overall. This, as well as disapproving the pseudo-integration strategy, are important indicators of a change in awareness. Similarly, Ann identifies in her second essay that anticipating counterarguments and refuting them made her more confident about her position. Furthermore, she thinks that planning out her arguments helped her to formulate her position early on and write her essay easier without being distracted or losing focus.

> Interviewer: Ok, and finally if you think you have learned anything today what would this be?
> Ann: The opposing and supporting thing is probably something I should do in future writing.
> Interviewer: More you mean?
> Ann: Yeah, because that's really useful for having the ideas but that means I can just write. Last time I was doing a lot of um-ing and erm-ing over --
> Interviewer: Um-ing? You mean like, fillers?
> Ann: Yeah. Being quite indecisive, I was being very indecisive over what I was writing and if you look back at it, it probably looks like I do lots of deleting and then writing and deleting, this felt like it just, flowed more. That was better. So the picking a point and sticking to whether it opposes or supports something makes an essay easier to write, definitely.

Interestingly Ann's perception about 'taking a middle position' changes dramatically from valuing it as a great strength, in her first essay, to diminishing it, retrospectively, to a weakness in the post essay. When she is asked during her first interview to name a weakness she refers to 'digressing from the essay question' and as strength she refers to 'taking a middle position'. However, when in her second interview she is asked if using the method helped her to overcome her weaknesses in writing, incidentally, she refers to 'taking a middle position' as her main weakness. She believes that advancing ideas dialectically made it easier for her to take a clear position, which, in turn, improved the flow and focus of the essay. Hence, it can be argued that both Fern and Ann report some improvement in awareness about their argumentation schema.

On the contrary, Shaun's awareness of argumentation remains unchanged (Table 6.17). Shaun's profile from his first interview could be summarized in that he rejects the refutation and plans very little. In the second interview, he fears that constantly bearing in mind opposing views and counterarguments makes him losing sight of his own position. He posits that being analytical about his argumentation did not help to support his position.

> An advantage would be that you can formulate the argument in your head in a clear way and you see things a lot better. But disadvantage would be that you tend to do that so much that you don't really make your own kind of conclusion, because you are considering opposition - support, so you are more just suggesting loads of different opinions rather than formulating your own (Shaun).

Pseudo integration unaware: No change in awareness			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Difficulties reported are relevant to argumentation schema	**Failing to understand integration process**	**Contradictory view about impact of diagramming**
Shaun	Difficulty about position formulation remains	Difficulty with integrating arguments in text: Including the opposition make your own position disappear	Diagramming helps to create a clear mental representation of the arguments but does not help with formulating position. Being able to reason about an opposing position does not invite revision of own belief.

Table 6.17: Pseudo integration unaware: No change in awareness

Analysing alternative views exposed an internal conflict between what he believed his position was (i.e. 'Students should not pay tuition fees') and the opposing position, about which he provided counterarguments and refutations (i.e. 'Students should pay tuition fees'). The issue for him here is that that he was not able to support the position he felt emotionally closer to.

> You don't really form your conclusions in a way because you are like, if someone asked me about it now, like I formed a conclusion but I don't really, I don't think I'd say that I really believe it but it was just because it was an essay I had to, I felt like I had to fall on one side, but I really did not know what, like which to choose, you know? (Shaun).

From the interview we know that Shaun focused on the opposing view only and did not provide argumentation to support what he felt to be his position. The conflict between his position and the alternative view did not drive him to review his position.

6.4.3 Differences in perceiving the impact of the computer-based diagram method

In terms of using the computer-supported method two different attitudes emerge: a sceptical one, recognizing the need for practicing more the method; second, an appreciative one, valuing many features of the computer-based method, and criticising others.

Shaun develops a sceptical attitude towards using the method. He reports that he would rather use the method on paper because the medium is more manageable and easy to use everywhere even during exams. He also comments that he would like to practice more with the method to appreciate fully its potential. For him the main advantage of diagramming is that it helped with focusing on fewer points and developing them more in depth.

> I think if anything it has made me focus more, like refocus my attention on and it reminds me to just really consider other side and then other side of an argument and then kind of try and constantly disprove yourself (Shaun).

He acknowledges that diagramming helped him to create a clear mental representation of arguments and to contest statements by introducing counterarguments and refutations. However, considering the opposition did not help with formulating a position and believing in it. Shaun did not explore arguments supporting his position. However, there are no sufficient suggestions in the interview to believe that this was due to interacting with the diagram. It is possible that Shaun became cognitively overburden and neglected to develop the supporting side. It is also a possible that he found difficult to adopt the new planning method because he

usually plans little and because there was limited time for practice. For whatever reason, it looks like diagramming was not fully applied.

Fern and Ann appreciate many features of the computer-supported method and share quite a few comments about it. They both report that diagramming helped them to invent ideas, shape them into arguments and develop them in depth. They also commend the function that allows the user to evaluate the content of the textboxes in terms of strength and relevance. Interestingly they both comment that this function is useful for identifying relevant ideas and excluding those that do not fit in the essay.

> Interviewer: What is you first impression about using this method?
> Fern: I did find it useful, especially the weak and strong thing, because these two points in the end I didn't even use, couldn't feel that they helped, so even though they were in the plan I didn't use them, so I did find the weak and strong thing useful. The evaluation thing, I did that one and I did the opposition and then, when I was evaluating, I leave that and that, so I had three strongest points there.

Constructing the diagram takes long and requires effort but Fern and Ann consider that this is time well spent. These two participants found that the process of interacting with the diagram, arranging and rearranging textboxes, and assigning orientation to statements eventually contributes to making writing easier. Furthermore, Ann compares the spider diagram, which is typically the plan she usually does on paper, to the computer-supported diagram method, and identifies another advantage of the diagram method. Planning with the diagram allows her to develop ideas in depth and manage the cognitive load she faces during writing. The diagram of the method is much closer to formal writing. When using the spider diagram many new ideas would occur to her, which are not in the spider diagram, but she would not interrupt what she is writing to develop further. Hence these ideas are forgotten.

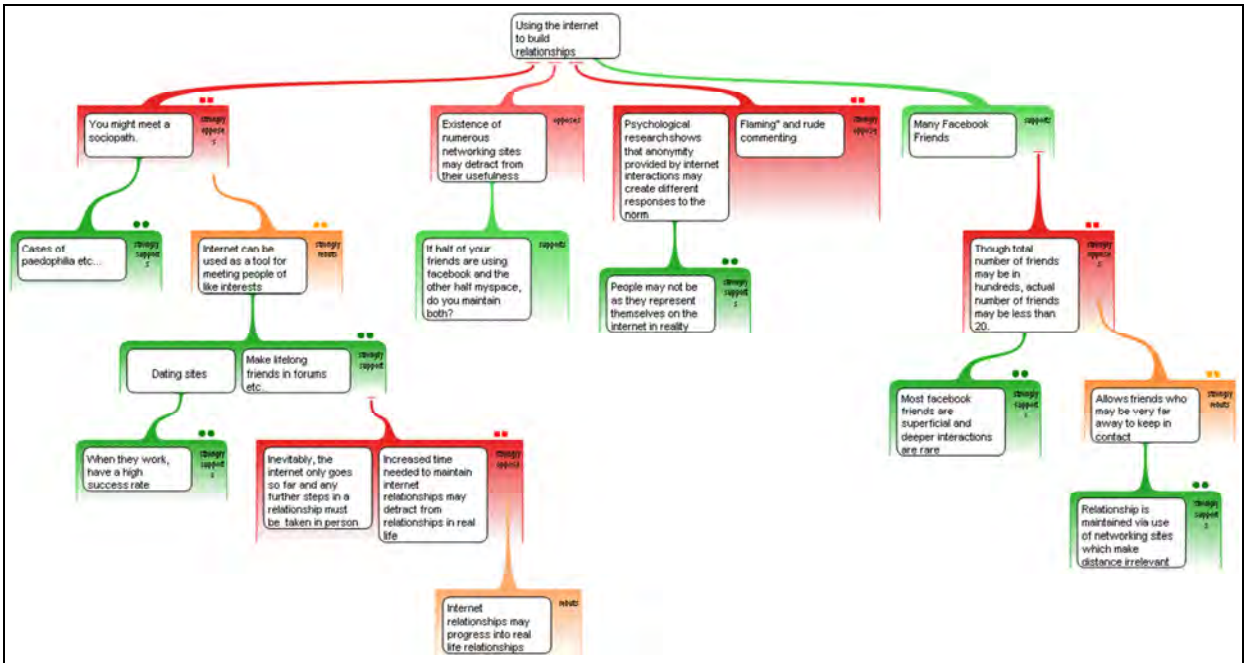
> Ann: This (the computer diagram) is more formal than this (the spider diagram). So it feels like this is kind of like writing an essay just in diagram form, because it's like writing an essay, what would happen when I would write an essay anyway happens to the diagram. So whereas if I was normally just writing the essay in like full-bodied text of words and

> trying to make it flow any point that I thought of here say, wouldn't end up here (in the spider diagram), so --
> Interviewer: Wouldn't.
> Ann: No, because I would, unless it was really important and I thought yes, and then I sort of, but I'd break my train of thought half way through and normally I just don't bother.

Fern and Ann develop and appreciative attitude, especially in comparison to Shaun. However, they make some well-grounded criticisms referring to the automatic outline function and the notation of the *Rationale 2*™ software.

The computer program affords a function whereby copying and pasting the whole diagram on a text editor results into automatically creating an outline (Figure 6.3). The produced outline retains salient information of the diagram, such a tree-like hierarchy, levels of argument evaluation (e.g. strong, weak) and orientation of arguments (e.g. highlighting the outline text with similar to the diagram colours). Ann observes that linearizing the content of the plan into an outline, before starting writing, is problematic. She thinks it is difficult to follow the direction from top to bottom.

Fern objects strongly to this function, but deals with this by creating her own outline by copying and pasting text from each of the diagram text boxes and editing it later on. Fern's criticism about the automatic outline function stems from her conviction that it is necessary to transform content between planning and writing because it helps to assimilate how ideas are connected, and review the content that will eventually be included in the first draft. Fern thinks that during planning it is better to work on the diagram as this helps to invent arguments. During writing Fern relies on the outline she made herself and does not return to the diagram screen at all. She finds the outline easier to use during writing because she is familiar with a linear type of plan and thinks of it as 'more organized'. She concludes that her usual rhetorical plan could be informed by keeping the representation of argument orientation with colour as in the automatic outline.



Using the internet to build relationships

1. Opposed by **:
a. You might meet a sociopath.
    1. Supported by **:
    a. Cases of paedophilia etc...
b. etc.
    1. Rebutted by **:
    a. Internet can be used as a tool for meeting people of like interests
        1. Supported by **:
        a. Dating sites
            1. Supported by **:
            a. When they work, have a high success rate
        b. Make lifelong friends in forums etc.
        c. etc.
            1. Opposed by **:
            a. Inevitably, the internet only goes so far and any further steps in a relationship must be taken in person
            b. Increased time needed to maintain internet relationships may detract from relationships in real life
            c. etc.
                1. Rebutted by:
                a. Internet relationships may progress into real life relationships
2. Opposed by:
a. Existence of numerous networking sites may detract from their usefulness
    1. Supported by:
    a. If half of your friends are using facebook and the other half myspace, do you maintain both?

3. Opposed by **:
a. Psychological research shows that anonymity provided by internet interactions may create different responses to the norm
    1. Supported by **:
    a. People may not be as they represent themselves on the internet in reality
b. Flaming" and rude commenting

4. Supported by:
a. Many Facebook Friends
b. etc.
    1. Opposed by **:
    a. Though total number of friends may be in hundreds, actual number of friends may be less than 20.
        1. Supported by **:
        a. Most facebook friends are superficial and deeper interactions are rare
    b. etc.
        1. Rebutted by **:
        a. Allows friends who may be very far away to keep in contact
            1. Supported by **:
            a. Relationship is maintained via use of networking sites which make distance irrelevant

Figure 6.3: Diagram and automatically generated outline (Ann)

Ann's main criticism about the computer method refers to the "rigidness" of the notation, in that it does not allow to draw informal links between the tree branches forcing everything to be assigned 'for' or 'against'.

Both Ann and Fern appreciate that the diagram helped to see the advantages of weighing and refutation strategies in argumentative writing but did not help with linearizing. In summary, the two participants, Fern and Ann, progressed to the category of aware-and-oriented. They appear to be more reflective towards their strategies in the second interview able to monitor and evaluate the implementation of the new strategy, and resourceful in proposing a better use of it. Regarding the argumentation schema, they appreciate important principles of integration, such as refutation, however they do not report how exactly. they implement integration, hence they are still categorized under the same schema, the pseudo integration. Shaun, on the other hand, gives a contradictory and confusing account regarding the impact of diagramming on argumentation formulation practice. Hence, it is not possible to argue that his awareness about the argumentation schema progressed.

Finally a few points may be raised regarding the software functions. First, the automatic outline may obstruct content transformation between planning and writing. There should exist a clear mapping between different representations of the argumentation schema, such as the diagram and the outline, making the transfer between the two seamless. Secondly, allowing for provisional and informal elements of the notations on top of the formal one is another emerging requirement.

6.4.4 Pseudo-integration and aware-but-lost as initial schema

The aware-but-lost participants, Mary, Sheila and Antony are aware of their own abilities and difficulties. They consider that taking into account opposing views and counterarguments is a strength, but integrating arguments and counterarguments while deliberating over a position is

difficult (Table 6.18, 1st column). This is typical in the pseudo-integration approach: they have some understanding of integration strategies but refer to it as difficult to implement (Table 6.18, 2nd column). They also report about what they do in trying to deal with these difficulties but come up with less ineffective strategies (Table 6.18, 3rd column).

The three participants share a common difficulty regarding argumentation; the difficulty to deliberate over their position (Table 6.18, 1st column). Mary is preoccupied with what her position will be while new arguments and counterarguments accumulate in the text.

> Interviewer: Ok, from those that you have ticked, which one do you think was more difficult to tick?
> Mary: Probably clear position. Coz at the start I wasn't like entirely sure which way I'd go. I thought I'd go with 'no' and then when I started writing the 'yes' points first, and then I just, like I had a lot more of that and then I realised I agree with that more, so.

Similarly to Mary, in the quote above, Sheila starts writing her essay, having in mind to support one side, but midway through writing she changes position. Antony is concerned about how to evaluate the balance of his argumentation.

All three participants are aware that deliberating over their position is difficult (Table 6.18, 3rd column) but do not employ effective strategies in dealing with this difficulty. As seen in the quote above, Mary attributes the difficulty to formulate a clear position to the difficulty of monitoring the balance of arguments and counterarguments. She further discusses the difficulty pointing out the issues she has with unclear structures.

Characteristics of pseudo-integration aware-but-lost (based on analysis of interview PRE)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Strengths and limitations relevant to integration strategies	**Integration strategies reported as difficult to deliver**	**Monitoring of difficulties but no effective solutions**
Mary	Difficulty with deliberating over own position. Preoccupied about position reflecting argument balance Arguments usually presented in an unclear and confusing manner Strength: inventing arguments for and against.	Takes position and opposition into account but counterarguments are not clearly presented. Presentation of ideas based on themes rather than argument orientation.	Difficulty with monitoring balance of position. - Changes position as new arguments and counterarguments emerge Careless and rushed writing usually results to awkward phrasing. - Does not like revising. Elaborate planning
Sheila	Difficulty with deliberating over own position. Preoccupied about position reflecting argument balance Developing points in depth and focusing are difficult Strength: inventing arguments for and against.	Takes counterarguments and refutation into account but worries that may weaken position. Difficulty with integrating arguments and counterarguments in the same paragraph.	Difficulty with position. Preoccupied about whether position reflects argumentation balance. -She changes her position midway through writing her essay Varied planning. Returned to planning after writing
Antony	Difficulty with deliberating over own position. Preoccupied about how weighing arguments and counterarguments affects position. Developing points in depth is usually difficult. Strength: inventing arguments for and against.	Difficulty with refutation (owing to lack of knowledge of schema).	Difficulty with balance of argumentation. Concerned about evaluation of argumentation. - Vague and limited use of planning.

Table 6.18: Pseudo-integration aware-but-lost as initial schema

> I think sometimes I try to get like everything out at once and get muddled up.[…] I try to get like four points out at once, like in one sentence, so it won't make sense when you read it back […]I write quite quickly and I don't read over it properly at the end I get a lot of awkward phrases. So like some sentences like, they will make sense but barely and like it's really awkwardly phrased and – (Mary).

Mary's reference to composing and revising evokes elements of the knowledge-telling approach. Anthony's limited engagement in planning may also be an indication of this approach. True to the pseudo-integration schema, all three participants present the ability to invent arguments and counterarguments as one of their strengths but acknowledge difficulties in integrating supporting arguments with counterarguments in the same paragraph. Nevertheless they lack the ability to deal with these difficulties effectively. Mary fears that her counterarguments are not clearly presented but, as she mentions elsewhere in her interview, she organises her arguments thematically. Sheila is getting confused when she integrates arguments and counterarguments and therefore decides to ignore counterarguments.

> Sheila: I think, I get confused a little bit with counter arguments. So to have an argument and then go against it and then have another argument I think, I just get confused. I think it makes me wonder was my first argument weak or was it strong and I think just that there is a counter argument to what you really said. Just, I'd find it easier to just leave it out.
> Interviewer: Ok, so you would tend to leave out a counterargument that weakens your position.
> Sheila: Yeah, definitely.

Finally, Antony is concerned about how to evaluate the balance of his argumentation. Nevertheless he admits he rarely plans his text in advance or, when he does, he simply jots down a random list of points.

6.4.5 Minor pseudo-integration shifts amongst aware-but-lost

A minor shift is observed in the way the 3 aware-but-lost participants, Mary, Sheila and Antony, perceive argumentation difficulties, process and strategies in the second interview. After being introduced to the diagramming method the participants overcome some – but not all – difficulties, enhance their knowledge of integration strategies, and show ability to

monitor the difficulties that the more advanced integration processes bring about. Self-reported evaluation of the diagramming method reveals a greater satisfaction by the users of the paper-based method, Sheila and Antony, as opposed to Mary, who is using the diagramming method on computer.

The first characteristic of the minor shift towards an improvement of awareness about the argumentation schema is that the participants perceive that they overcome previous difficulties with argumentative writing (Table 6.19, 1st and 2nd column). Mary, for example, who had difficulty with 'muddled up' argumentation structure, likely caused by rushed writing and no revising, sees the positive impact of more 'thorough' and 'structured' planning.

> Interviewer: When I asked you the other day what you think is your weakness in argumentative writing, do you remember what you said?
> Mary: I think, oh god, it might have been like rushing a bit and like not, like trying to get too much things out at once. But I think this kind of helps that, coz you have to think of everything so thoroughly in the plan and it's like, coz like I said before it's really structured, you are not trying to get everything out at once. So I think it helped with that.

Mary finds positive aspects in using the computer-based diagram method. She finds this type of planning very useful for organising her ideas prior to writing. She acknowledges that diagramming makes writing easier although, comparing with her usual planning strategy, is more difficult. She sees the benefit of engaging into thorough planning and deeper development of arguments prior to writing, if compared to expanding on them during writing.

Characteristics of minor shift: from Pseudo integration aware-but-lost to Pseudo integration aware-and-oriented			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Some- but not all- difficulties are overcome	**Knowledge of process appreciated with reference to its impact and in comparison to previous practice.**	**Advanced processes are adopted but are met with further difficulties Ability to monitor and evaluate diagramming experience**
Mary	Difficulty with 'muddled' structure resolved with better organising structure during planning. Difficulty with refutation partly mastered. Difficulty with deliberating over position and integrating multiple views persists.	Knowledge about text organisation process improves. Diagramming encouraged deeper processing of ideas.	Difficulty with integrating complex diagram structure in text emerges -After expressing multiple opinions in planning it was difficult to merge them in one position Extended criticism of the computer based diagramming method.
Sheila	Confident about position formulation and inventing counterarguments. Difficulty with developing points in depth is overcome Difficulty with intergrading arguments and counter augments in same paragraph persists.	Deeper processing of argumentation. Linearization process is supported through reflection on diagram . Colour contributes to refutation of counterarguments	Less difficulty with counter argumentation but more difficulty with clear argumentation. Extended list of advantages of method; no disadvantages mentioned.
Antony	Difficulty with developing points in depth is overcome Easier to mentally represent position and opposition. Difficulty with refutation is partly overcome.	Colour contributes to visualisation of argument orientation. Writing supported by following 'trains of thought going down in lines' (linearization) .	Extended list of advantages of method; no disadvantages mentioned. Refuted counter-arguments in planning appear weak in writing. Refutation process considered learning gain

Table 6.19: Minor Pseudo-integration shift, from aware-but-lost to aware –and-oriented

The difficulties that Sheila and Antony perceive to have overcome are more pertinent to argumentation processes than those mentioned by Mary. Sheila is becoming more confident about her position thanks to the planning process. Reflecting on the diagram made her confident enough to include her position in the introduction while she would usually avoid this in case she changes her mind later in the essay. She also overcomes her difficulty with developing arguments and counterarguments in depth and identifies the advantage of the proposed method over her usual planning practice in representing associations between arguments, and in symbolizing argument orientation with colour.

> Interviewer: Right, do you think this was more demanding or the plan you did the other day?
> Sheila: I mean once you get the knack of doing charts like this, I don't think you do this naturally but I think it's easy to just do two columns like for one side and the other. But then I think this is better in getting you to use counter arguments, getting you to think of it more than just black or white, so I guess this is better.
> Interviewer: Black and white was with --
> Sheila: before, I just had things that were good and things that were bad. But this gets you to think about why it's bad and makes you to bring out a lot more detail I think.

The second characteristic in this shift of awareness relates to the linearization process. All 3 participants are concerned about the clarity of their argumentation when the complex structure of the diagram is transferred in the text. Sheila observes that including counterarguments and refutation in her text may have impact on the clarity of argumentation. She is thus returning to her earlier concern regarding integrating arguments and counterarguments –and now refutation– in the same paragraph. In a similar way, Antony appears able to monitor and evaluate the adoption of new and more advanced processes. Antony, having previously acknowledged that he does not know how to refute counterarguments, he does refute now, acknowledging that that he would not have thought of 'discrediting' an opposition view before. However, when transferring the planned refutation on text, he, too, finds that he needs to be careful with clearly expressing his argumentation and position.

When Mary integrates in her text the complex structure, that emerges from planning, she finds difficult to combine various points or views in one clear position. Previously, in her first interview, she mentioned her concern about deliberating over her position while compiling arguments and counterarguments. In her second interview, trying to combine opposing views in an 'in-between' position is considered problematic:

> Interviewer: Anything else [referring to negative experience from using the method]?
> Mary: Not really. I wasn't like, like I didn't really have a really clear stance at the topic. I tried to in the essay. But it was a bit like annoying how to think 'ah' and I have to say this point and this point, but then which was I as supposed to be supporting it and –
> Interviewer: Sorry, I didn't understand that. That you were trying, you didn't have a position
> Mary: Like, I, like it wasn't kind of really clear cut position, like it was a bit muddled.
> Interviewer: Your position was in between--
> Mary: Yeah.
> Interviewer: And it was difficult for you to express it with planning?
> Mary: Yeah, no, the planning was fine but like when I was thinking about the planning it was a bit like, oh, no, but how do I say this as well, and like try to fit it all in. And then coz some of the points overlapped as well, I was do I mention them again? Do I just leave them?

Further observation of her planning and writing process is needed to confirm whether Mary was actually trying to establish a synthesis of various views. If this is the case then a question is raised as to what made her think that not having a 'clear cut position' is a problem. Mary had already expressed in her first essay that she prefers a 'yes or no argument' and that she would rather avoid 'middle bits'. It is possible that the first item of the list, 'Do I take a clear stand in the debate?', may have confusingly reinforced her preconception. On the other hand diagramming might have made her see that a position may not always be a clear cut 'yes' or 'no'.

6.4.6 Greater satisfaction expressed by users of paper-based method

The third characteristic of this minor shift is that the 3 participants appear able to monitor and evaluate their experience with the diagramming method (Table 6.19, 3rd column). We saw

already that they observed that changing the argument structure brings about concerns about complexity and clarity of argumentation. Further to this they also identified issues regarding the usefulness and the usability of the method (Table 6.19, 3rd column). Interestingly, Mary who is using the diagramming method on computer is criticising the method extensively, while Sheila and Antony, who are using the method on paper, identify only advantages. Mary developed an extended diagram on the screen but expressed many concerns about using the diagramming software in the future. The diagram was difficult to overview and handle on the screen.

> It can be like confusing when you look at everything coz mine was like really thick. Yeah, it was also like you couldn't really like see everything at once. Like at least when it's on paper I could see it all there, whereas [ ] coz it was so much it was like zooming in and then if you zoomed out you couldn't really read it, so. (Mary).

Mary also pointed out that it was not possible to physically tick off the content of the diagram while she was including it in her essay. Turning the diagram into an outline was cumbersomely done. Instead of using the automatically generated outline she, copied, pasted, linearized, and finally colour coded the statements of the diagram to represent the mapping of the diagram onto the outline. She suggests that although she would use the software for planning she would not adopt the automatic outline function.

Sheila and Antony mentioned that the diagram, and in particular the use of colour, helped them to overview the structure of their argumentation, to visualise the orientation of arguments, and to gain understanding of where the content may flow better or needs reworking. Diagramming also helped them to invent counterarguments and to refute them. They both referred to how the diagram helped them while writing, by following their 'train of thought going down in lines'(Antony). Sheila's quotation below summarises the identified advantages of the paper-based method:

> I think this method is a lot clearer. I think it makes essay writing easy as well, because it's all on one page. You know where you are supporting, and you can just look at this and decide which bit is support, which oppose, and where you are leaning on. And all you have to do afterwards is just number, how am I gonna write it out and I think it was a lot easier than what I did the other day (Sheila).

Overall, the 3 participants improve to some extend their awareness about argumentative writing: they saw they could deal with some of the known difficulties; they realised that the diagram generates a more complex but necessary structure which they need to accommodate in their writing. Although all 3 are considered to improve to aware-but-lost, Sheila and Antony perceive a greater benefit from the diagramming method, in comparison to Mary, and they overcome difficulties that are more salient to the argumentation process.

6.4.7 Pseudo-integration and aware-and-oriented as initial schema

The aware-and-oriented participants, Harriet, Fiona and Diane have some knowledge of integration principles (Table 6.20, 2nd column) and a well-developed sense of own limitations regarding argumentative writing (Table 6.20, 1st and 3rd column). Nevertheless, they somehow remain 'trapped' in the pseudo-integration schema, as they doubt about when or whether integration strategies should be employed, and have incomplete knowledge about integration.

The three participants confidently express strategies that contribute to integration of supporting arguments and counterarguments (Table 6.20, 2nd column). Harriet articulates her strategy of anticipating both sides of an issue and presenting counterarguments before refuting them. She present these strategies with confidence as if they consist principles of her argumentative writing.

> Especially in argumentative writing I need to know both sides before I do anything, because if I started and I haven't thought about both sides I am liable to not have a proper structure. I need to do my thinking beforehand. […] I bring in the opposing arguments to my point, especially if you are going to talk about the opposing points you need to make them really clearly substantiated and then rebutted (Harriet).

Fiona and Diane are also quite clear about the importance of formulating and maintaining a position throughout the text. Diane is employing a weighing strategy and Fiona a refutation strategy.

The three aware-and-oriented participants are able to name their difficulties and identify plausible causes (Table 6.20, 1st column). Furthermore, a common cause of difficulty they name is whether their rhetorical approach is appropriate for a written assignment, as it is the case with Harriet (Table 6.20, 1st column, in italics). Fiona thinks she is influenced by the way she used to write for A-levels and, believing that the requirement at university is to take a clear position in her assignments, tries to avoid "sitting-on-the fence".

> Fiona: Yeah. I do lots of essays, yeah.
> Interviewer: Do you have to follow a structure where you have to take a position and argue about it?
> Fiona: It's not really clear, it depends on the module really. But I tend to, I think coz I am still really stuck in the A-Level forms of on one hand, on the other hand, in conclusion, I still sort of tend towards that. But I try to take a stance and maintain that.
> Interviewer: Do they advise you to do that?
> Fiona: Yeah. Yeah, they want you to say I agree with one. They don't like to sit on the fence.

'Sitting on the fence' is perceived by the participant as presenting the two sides of an issue separately. In a way Fiona criticises, here, the 'sitting on the fence' approach for lack of integration. No effort about contrasting the two sides is mentioned. The conclusion in the end of the essay does not follow the development in the body of the essay. The quote shows that Fiona thinks that she is not following an appropriate rhetorical approach for university essays.

Characteristics of Pseudo-integration aware-and-oriented (based on analysis of interview PRE)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Aware of cause or impact of difficulties. **Confusion about schema or strategy** [in italics]	**Knowledge of integration strategies**	**Responding to difficulties with sensible strategies** **Lacking in knowledge about how to implement the integration schema** [in italics]
Harriet	Digressing is caused by including too many personal examples Difficulty with structure: Wonders about what are the appropriate rhetorical schema in a range of written assignments.	Anticipating equally position and opposition before starting writing Counterarguments should be clearly presented before being refuted.	Difficulty with structure is dealt with extended planning using diagrams, arrows and numbers. Being biased helps with being persuasive
Fiona 0	Difficulty with taking a clear position. Affected by her A-level tendency of "sitting on the fence" . Concerned that trying to refute all counterarguments may not be the appropriate strategy.	Un-refuted counterarguments may upset the strength of the position A position should be taken and maintained throughout the text.	Usually she would not refute counterarguments, but she is not rejecting the approach altogether. Position taking is defined by genre-specific (here, university assignment) rhetorical requirements, and not by argumentation processes like integration.
Diane	Difficulty with taking a clear position. Newly invented arguments change the balance of position Difficulty with unclear structure caused by not know how to structure paragraphs. Difficulty with prioritising arguments: unsure whether strong or weak arguments should be presented first.	Position should be clearly defined despite any difficulty Weighting up arguments and counterarguments to confirm position	When realised that her position may not be supported returned her plan to review her arguments (resource planning) Weighing argumentation during planning is fine. Turning planned ideas into text is difficult. Refutation not fully understood

Table 6.20: Pseudo-integration aware-and-oriented as initial schema

Diane discusses her difficulty with rhetorical structure and in particular with whether to write about strong or weak arguments first. She believes that study-skill books have influenced her in starting with the stronger argument first. Nevertheless, she is not sure what she is supposed to do for university assignments.

In comparison to the aware-but-lost participants, the aware-and-oriented react to their difficulties more effectively adopting sensible solutions (Table 6.20, 3rd column). When Diane realised during her writing that she may not have thought of enough argumentation to support her position, she did not change her position, but returned to her plan to reflect on her argumentation. Fiona expresses a concern that aiming at refuting counterarguments is not the most appropriate strategy, 'you may be caught up in doing this too much'. However she does not reject the refutation strategy altogether. Harriet deals with the difficulty of establishing a structure with extended and elaborate planning.

Despite the well-developed sense of their difficulties and their knowledge of integration principles the three participants have not grasped important aspects of the integration schema (Table 6.20, 3rd column, in italics). Harriet believes that being biased helps with being persuasive. Diane ignores what refutation is and she is thus far from combining refutation and weighing into an integration practice. Fiona is rejecting, as we saw earlier, a 'sitting on the fence' approach, thinking that for university assignments one should be able to support one position only. But in doing so she also rejects a process whereby one could creatively integrate both sides of an issue in a compromise position, such as in the synthesis schema.

> Fiona: I think I find it difficult to fix on a position, coz I tend to, I am one of these people who sees both sides and I find it quite difficult to say actually no, you know, this is the one position that's correct and everything else is wrong completely. I tend to prefer to sort of take bits of each thing and say oh, well, I like this but not this and -
> Interviewer: So you think that's a weakness?
> Fiona: Yeah, I think it's a weakness not to be able to just go, no, this one is right. Especially with University work anyway.

Unfortunately Fiona is not concerned, here, about the integration process and how this contributes to formulating a position. Position formulation seems to depend, according to her, on genre -specific (here, the university assignment) rhetorical requirements. Fiona seems that she has not grasp that the integration processes contributes to position taking, and may underlie both cases of position taking : when one only position is supported and when opposing positions are creatively combined in one, like in the synthesis schema. Instead she is preoccupied about what is the appropriate 'position taking' form for university assignments.

Overall the aware-and-oriented participants are conscious of their difficulties, which they try to regulate with sensible strategies. In principle, they know about integration strategies. However, there are still aspects of the integration process that they need to clarify or learn. On this basis they are classified as aware of their limitations and oriented towards applying integration strategies but still influenced by less advanced schemata.

6.4.8 The paper-based method users progress to the integration schema

The three participants Harriet, Fiona, and Diane were described, earlier in this chapter, as being defined by the pseudo-integration schema on the basis that they have not learnt or clarified some important aspects of integration. According to their first interview, they were also described as aware-and-oriented, that is aware of their limitations and oriented towards applying the more advanced integration schema. The second interview indicates that Fiona and Diane, the two participants who used the planning method on paper, have advanced their awareness regarding integration strategies, while Harriet, the user of the computer-based method has not. In the case of Harriet, the computer method appears to limit the opportunities for reflection on the diagram and knowledge transformation between content and rhetorical planning.

The two participants, Fiona and Diane, who significantly advanced their awareness, adopt integration strategies and improve their planning and linearizing strategies. Using the paper-based diagram method helped them to identify ways to deal with difficulties (Table 6.21, 3rd column), which they had previously identified (Table 6.20, 1st column).

Fiona mentioned three difficulties in her first interview. First, the difficulty to take a position and, in particular, to avoid 'sitting on the fence'. In naming this difficulty Fiona criticises her writing for failing to integrate opposing sides and for presenting supporting arguments separately from counterarguments. In her second interview, Fiona understands how a position is defined on the basis of integrating supporting, countering and refuting arguments.

> It [the diagram] allowed me to see really clearly that my statement was the correct one that I was gonna agree with. I mean in terms of having much more green and then having the red, but then having the red underneath, so obviously contradicting, you know, being able to say I've got a clear line I can take (Fiona).

Fiona mentions, in her second interview, that she uses the diagram as constant reminder of the way she reached a position, and that this helps her to maintain a position throughout the text. Visualising the structure of argumentation on the diagram and the orientation of argumentation with the help of colour made her confident about her position. The second difficulty refers to how to best frame a position, i.e. whether to take one side or reach a compromise. In her first interview, Fiona thinks that this is defined by rhetorical requirements of the 'academic assignment' genre (Table 6.20), whereby a clear position is favoured. In her second interview, she improves greatly in the way she perceives the process of position taking (Table 6.21). She understands that it is important to reflect on a position rather than simply support it, and that arguments of one side need not to be presented separately from arguments of the other side.

Characteristics of major shift: from Pseudo integration aware-and-oriented to Integration unaware			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	No new difficulties mentioned	**Gain in knowledge of process integration schema through comparison with pre**	**Elements of the method help to overcome previous difficulties of integration**
Fiona	Aware of learning curve in adopting method	An outline constructed after the diagram contributed more effectively to linearization than two rounds of rhetorical planning (usual method) Interleaving: Ideas invented during writing were added on diagram (management of memory load).	Become confident about position taking through visualisation of argumentation - Diagram as a constantly visible point of reference for position Counterarguments should be related to supporting arguments; one should avoid to present arguments separately to counterarguments Becomes aware of how integration process contributes to position taking. - reflecting on position not simply supporting it. - pre-empting and refuting counterarguments
Diane	Aware of learning curve in adopting method	Able to identify improvement in position and text focus in comparison Possible transfer of skill to legal reasoning Stops 'sitting on the fence'	Appreciation of planning method: time worth invested, use of colour, formulation of a stable position Clear position becomes less of a difficulty.: alternative views organised around a position

Table 6.21: Major shift in awareness of two of the pseudo-integration & aware-and-oriented participants into integration & unaware

Quite importantly she sees that this approach is better than her usual 'confusing' one.

> Interviewer: So if there is anything you learned from this method what this would be?
> Fiona: It really helped me to realise that I need to have a point and stick to it and then to think about instead of just supporting it.. So I guess before I probably would have just gone for the top line [referring to top boxes of diagram] and just written that out and then gone for the counterargument and then being confused about how they relate to those. Actually pre-empting the sort of counter arguments that people might say, "ah...but" and say "well I thought about that and actually my argument still stands". So I think it's more developed in that way. And less sort of 'one', 'two,' and then, you know. It's bringing it all together which is good.

In this statement we also see that Fiona refutes counterarguments without any concern, which was the third difficulty she mentioned during her first interview.

Diane reported two main difficulties in her first interview. First, taking a position was considered a difficult task because the accumulation of arguments and counterarguments in the essay change the balance of her position. Second, she has difficulty with translating her plan into text, in particular paragraphing and prioritising her arguments. Diane's is less able than Fiona in articulating the strategies she followed during planning and writing. Nevertheless, she is very enthusiastic about the diagrammatic method when she explains how it helped her to improve her essay and overcome difficulties mentioned in her first interview. Regarding the first difficulty, the position overview, Diane compares her two essays and identifies an important change in rhetorical structure. In her first essay, through engaging in an internal dialogue, the text covered many views but lacked in focus. In the second, the text focuses on the writer's position around which other views develop. Following this comment Diane observes that she no longer 'sits on the fence'.

Regarding the second difficulty, i.e. organising argument structure and paragraphing, Diane commented that the order of covering the content of the diagram textboxes came to her 'naturally' from making associations between diagram branches and from integrating different views around a central position.

> Because my opening paragraph is sticking to my clear position. And then that's how I've sort of carried through, throughout the essay. Even though I've said some opposing things, I come back to my first initial clear position. I think it helped to put the paragraphs how I did, and then it's just flow well. I didn't have to say 'oh! this should be more at the top' or 'this should be at the bottom or the middle' because I didn't have three or four different views (Diane).

The method helped her to structure he text easier and with lesser confusion.

Furthermore, Diane is reflecting on the application of the argumentation schema she learned through the diagrammatic method. She observes the possibility of transferring the proposed argumentation schema in other contexts of use. She thinks the diagrammatic method would be useful not only in retrieving knowledge, as she does here, but also in guiding further research looking up resources and data.

> And I think first of all, I don't think you need to know a lot about the subject because obviously I don't know. I think with the research once you get your clear position, then that will guide your reading and your research. So I think doing something like this beforehand, before you actually doing your research, that would help you even more to sort of like back it up with facts and dates and stuff like that (Diane).

She also expands on other contexts of use; she mentions that she would had greatly benefited if she knew about this schema earlier when she had to produce an assignment that involved legal reasoning. This is a valid observation given that the diagrammatic method is often used in representing legal debates. It is worth noting here that, while the current analysis focuses on changes referring to declarative knowledge, such as knowledge of ability and process, (usually showing in the first and second knowledge of the tables) and procedural knowledge, referring to implementation (third column), the latter observations made by Diane refer to conditional knowledge. These are references to when and under what circumstances a strategy is used.

6.4.9 No progress for the users of the computer-based method

In comparison to Diane and Fiona, Harriet does not show evidence of advancing her awareness regarding argumentation processes or overcoming differences reported earlier. She enthusiastically praises many aspects of the computer-based diagrammatic method, in particular those that contribute to reducing time spent on prewriting and writing tasks.

No shift from pseudo integration aware-and-oriented			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
Harriet	Few disadvantages of the method are reported (e.g. not able to draw informal links) Difficulty about changing established method of planning reported	Planning and linearizing made easier thanks to possibility of copying diagram content word document	Participant strongly believes that the automatic outline process is accurate and superior to her previous planning process. Reasons of easiness are reported Many advantages of method are reported

Table 6.22: No improvement in awareness after using the computer-based method

Throughout, she expresses a strong feeling that the diagramming method is a better method than her usual one.

> Interviewer: If you would compare the process of writing today and the other day do you thing something has changed now?
> Harriet: Yes, it was much easier. Because you are never able to transfer the words from your notes to your real essay, you can't really do with paper. I think l sometimes doubt myself when I am typing my plan, perhaps that it is not quite right ...I keep rereading it. Whereas here I had already reread it and l have got it to this stage where on the screen it looks right and it flows nicely I feel so much confident to just copy and paste it into the word document.

Harriet strongly feels that what she does on the screen looks right, and that interacting with diagram makes the content look right and more organized.

> Interviewer: If I remember well you mentioned about refuting counterarguments in our previous discussion too…
> Harriet: I think I refuted them the first time but I think I refuted them more strongly here. And with the ease that you can add new branches and add new lines of thought you can get much deeper into an issue, if you feel what you are doing is well organized.

However, it is questioned how the advantages she mentions can improve prewriting strategies. During planning the main advantage she identifies is the flexibility of 'slotting into textboxes' everything she could think of. No effort is reported about linking textboxes together, identifying irrelevant content on the diagram, nor evaluating the weight of arguments. Nevertheless, the computer method provides functionality for assigning weight or level of importance to arguments and for representing irrelevant boxes.

> I was going to evaluate them all but I didn't really gone round to it. Because I knew what order they were going anyway. And there was nothing I wanted to leave out which I think, if I got too many points, I would have done it then. But I didn't feel I got too many.
> I think if it was a piece of university work I would be working longer but probably I would have more points than that. And in that case I would want to sieve them out. Which I haven't done for this cause is not that kind of work but is nice to know that I could do that if I was using the program (Harriet)

Very little effort is also assigned to the linearization process. The transformative process occurring between content plan and rhetorical planning is missing. While in her first essay she carefully planned the translation of her plan by adding numbers and rewriting it, and gave an extended account explaining the rationale of her linearization approach, in the second essay she praises the simplicity of automatically turning the content of the diagram into an outline. The outline is then turned into text with very little processing or transformation.

In contrast to Harriet, when Fiona and Diane talk about the advantages of the paper-based diagramming over their usual methods, they recognize an impact on argumentation processes: interacting with the notation of the diagram helps them to invent more arguments; visualising

the orientation of arguments with colour helps to overview the balance of the position; engaging longer in planning and linearizing makes writing easier.

> Interviewer: So, what is your first impression if you compare the essay the other day and today?
> Diane: This one was a lot more organised. I knew what I was doing because I took the time out to say what my position was and didn't sort of change throughout, that's when I said to you I've got lots of green boxes, I haven't got any red or orange ones. And when I thought a bit more, I said oh yea, but the government also say that people have to pay towards their education and stuff like that. But then I started to rebut, to say that students will contribute later on when they get employment. So, it was a lot more organised and it flowed a lot better, I think.

The only disadvantage Fiona and Diane see in using the paper-based diagrammatic method is the effort required in learning the method, while Harriet raises the point that it is difficult to change her usual method. Diane appreciates that time and practice is needed to learn the diagramming method but considers it a worthwhile effort. Fiona was initially hesitant about method, especially during training, but engaging in using it made her more involved in the process of argumentation and thus more able to develop arguments in depth.

> Interviewer: So what was your impression about using the method?
> Fiona: I really liked it actually. When we went through it before I wasn't sure how it'd actually work, when I had a topic and I just had to do it. But to start with I sort of only had a couple of points and I couldn't really develop them down. I've got sort of bits but then when you actually just don't sort of think about it too much, you just do it. And you suddenly sort of realise that you can think of other stuff.

Given that Fiona and Diane do not report any new difficulties in this instance they assigned under the unaware category, that is they have not – not yet perhaps – realised further difficulties or limitations. However, there is evidence to believe that they apply integration strategies. On the other hand, we have indications to believed that computer-based diagramming has not benefited Harriet..

6.5 Integration

6.5.1 Integration as initial schema

Integration is achieved by establishing a position on the basis of critically combining arguments and counterarguments. Arguers who adopt the integration schema use a weighing or a refutation strategy, or both strategies combined while they deliberate over a position. “In a weighing strategy, the arguer considers both sides and then considers which side has the stronger argument” (Nussbaum 2008, p.551). In a refutation strategy, counterarguments are shown to be “false, irrelevant, or insufficiently supported” (ibid). Based on their first interview, Deana and Liana are believed to be applying integration strategies. They are confident writers, report about using the weighing strategy mainly, and are aware of some difficulties. However these difficulties do not relate to the integration process. The two participants also express some inconsistencies between what they believe to be the requirements of argumentative writing and the process they actually describe. Based on the difficulties and the observed inconsistencies the two participants are assigned to the *unaware* category.

Deana and Liana are aware of difficulties that are not directly related to the integration process, i.e. the argument-counterargument integration and formulation of position. Deana refers to her difficulty with backing up her arguments with evidence from the literature and with digressing from the topic by being too descriptive. In a similar vein, Liana acknowledges, that she has some difficulty with digressing from the topic and backing up statements with examples.

Furthermore, the two participants are quite confident about their planning process. Deana provides the most thorough account of planning process amongst the 16 participants in this study. She is confident about her approach to writing, aware of the value of planning in

Characteristics of integration unaware (based on analysis of interview PRE)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Difficulties not relevant to integration process	**Integration strategies**	**Inconsistency between practice and argumentative writing requirement**
Deane	Difficulty with digression and loosing focus Difficulty with backing up statements with evidence and references	Articulate in describing planning process, argument deliberation, linearization Position deliberation and weighing strategy: Initial (provisional) position, weighting up of arguments leading to position taking, position confirmed through argumentation Argumentative writing represented as dialogue with imaginary interlocutor	Argumentation only, no conclusion need: Making argumentation but not concluding (usual schema) in political economy assignment Backing up evidence with references is not needed in political economy assignment
Liana	Difficulty with digression and loosing focus Difficulty with backing up statements with examples	Able in describing planning process, argument deliberation, linearization Refutation strategy is considered during planning	Inconsistent structure: A point, planned out as refutation, is included as supporting point when writing

Table 6.23: Integration unaware as initial schema

producing well-structured texts, and conscious that the weighing strategy is one of her strengths. Deana describes an iterative process during planning whereby she deliberates over her position using the weighing strategy. In previous sections other participants refer to a position deliberation process, however, they engage in it with great concern, worrying that as arguments and counterarguments accumulate the formulation of their position is confused

(see for example Table 6.18, Mary, Sheila Antony, categorised in their first interview as Pseudo-integration, aware-but-lost). Conversely, Deane is not experiencing such a concern and gives a clear account of her process:

- semantic links are established between ideas that are randomly invented;
- arrows are intuitively used to denote dependency or hierarchy between ideas;
- a preliminary conclusion or position emerges gradually from this process giving the writer an overview of where her position resides;
- weighing arguments against counterarguments helps her to confirm the validity of her position;
- returning to the plan she identifies the arguments that predominantly contribute to her conclusion;
- assigning numbers to groups of ideas is a first attempt to establish paragraph structure and linearity.

Liana is also a confident writer, acknowledging that she has a good, 'professional-like' style in writing. Liana is not as articulate as Deana in describing her writing process, however, her planning process is elaborate:

- she uses a spider diagram to semantically organise her ideas;
- she focuses on developing her ideas in depth;
- she associates ideas together either though lines or proximity on diagram;
- she does not produce a separate rhetorical plan or outline before embarking on writing her essay but she often checks her plan to see if she is covering all the points in the text;
- she reports no difficulty regarding the 6-item list.

Despite her developed awareness regarding argumentation there seems to be an inconsistency between what Deana believes to be the requirements of the argumentative essays and her account of argumentative process. As a political economy student she says she has to write a lot of argumentative essays, where she has to introduce a lot of arguments but without introducing a conclusion or position to the argumentation. Furthermore Deana's difficulty refers to backing up her arguments with bibliographic references however she says that in her essays she does not need to include references just arguments. Liana's inconsistency refers to

the use of refutation. She considers refutation during planning, but she uses the refuting statement as a supporting statement to her position when writing her essay.

> Interviewer: So on your plan you got "more people better qualified" as a counterargument?
> Liana: Yes.
> Interviewer: And then the points that are integrated there are the refutation?
> Liana: Yes. That one was meant to originally be my refutation intending to a supporting one..
> Interviewer: "more competition for courses" you planned as a refutation but then you thought….
> Liana: …I'll put it as a supporting because it seemed to work better like that at the time when I was writing it.
> Liana's second interview gives us more information about the schema she uses, both before and after using the diagrammatic method, as she compares her first and second essay. From this it is inferred that Liana, too, is using a weighing strategy.

The two participants have a good understanding of their planning process. They do not criticise their planning practices, on the contrary, they appear quite confident about them. This element, as well as some confusion over the requirements of argumentative writing and what refutation is, define the two participants as unaware.

6.5.2 No change in awareness of argumentation schema

The use of the diagram method encouraged the two participants, Deana and Liana, to compare the two strategies, the weighing and the refutation strategy, and to reflect on the process in which they engage as result of using the method. They are both reluctant to see the role of the refutation strategy in supporting a position. What is more, they cannot see a great benefit in engaging in the process of diagramming, especially in view of the extensive time and effort that is requited for designing the diagram on paper. In this case, as both participants used the method on paper we cannot compare with the computer method. The extended time and effort either in planning or in linearizing is not valued, although it motivated more reflection on the content and selection of arguments. Overall, it cannot be argued that their awareness changed after using the diagramming method on paper.

Characteristics of integration unaware (based on analysis of interview POST)			
	Knowledge of ability	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
	Difficulties reported are attributed to implementation	**Refutation strategy is not valued**	**Engaging with diagram not valued**
Deane	(See implementation regulation column)	Comparison of weighing and refutation strategy Enhancing own position with strong supporting arguments is a the strategy	Constructing the diagram requires a lot of time and effort Extensive development of diagram and selection of content before writing not considered advantage
Liana	(See implementation regulation column)	Comparison of weighing and refutation strategy Being less biased not considered advantage The problem with refutation is the existence of many non-refuted arguments.	Diagram elements needed to be developed and explained further in text Difficulty with clear position and conclusion as result of interacting with diagram Diagramming did not prompt revision of position , did not help to conclude

Table 6.24: Integration unaware participants do not improve their awareness after using the method on paper

Both participants compare their first essay with the second, where they had to use the refutation strategy as result of applying the diagram method. Deana examines the difference between the weighing strategy and the refutation strategy. She describes the weighing strategy as a 'balanced to own position' strategy, and the refutation as an 'even' development, where both sides are presented equally and counterarguments are refuted. Similarly to other participants. Deana is concerned that including opposing arguments may restrict her own voice, while enhancing her own position with strong supporting arguments makes her position more persuasive.

Deana is comparing the two strategies but cannot see how refuting counterarguments to her position can enhance her position:

> Interviewer: How about a disadvantage of this method?
> Deana: I think with this [the diagram], I am not sure if it's a bad thing or not, but you kind of try to balance everything a lot more. But that could be a good thing, but it also means that your own point of view, you kind of forget, you can't make everything like balanced. Like on the page [on the diagram] I had good things [pointing to the left side of diagram] and bad things [right side]. I was kind of making it level rather than balanced. I think in a normal argument I would have made it much more based on my own point of view so it would have been much more my own point of view but I don't know if that's a good thing or not.
> Interviewer: What do you mean by balanced?
> Deana: So like as in here I had two good things [left side of diagram] and two bad things [right side] and I made it even so I evaluated them both evenly. Whereas if I had just written as my own plan, I could have given out like three good things and one bad thing. I would rather say more balanced on my own point of view so it would have made it more obvious […] Like I thought that an essay should be balanced in terms of like your side should have more weight, as in your own view should have more weight.

Deane may not reject the idea of using a refutation strategy but she is not convinced that refuting counterarguments contributes to the support of her position. In a similar vein, Liana, compares the second essay, where she constructed the diagram using extensively refutation, with her first essay. She thinks that in her second essay she is less biased about her position, she can see both sides more clearly and she has included a lot of counterarguments to her position. But, overall, she does not think very positively about being 'less biased' in the

second essay. Not being able to refute some of the counterarguments left her confused about where she stands. As a result she faced great difficulty with formulating her position and conclusion. In her conclusion she takes a synthesis approach but it cannot be inferred whether the whole essay was written following this approach.

> I: What did you think about the topic?
> Liana: It was all right. I think I was more divided about this one as opposed to the other one. I thought there were some points from both sides rather than being a definite one side. I wrote it as if I was one side.
> I: But you were not..
> Liana: Well, I was, but more one side than another, I could still see some of the points from the other side. I was more for that people shouldn't use it about relationships. But I sort of put in my conclusion that if it's an existing relationship, it is probably be ok.

The use of the diagrammatic method encouraged the two participants to compare the two strategies, the weighing and the refutation strategy, but fail to make them see how refuting counterarguments could enhance their position. The two participants overlooked the possibility of combining weighing and refuting strategies. "Refutation can be used in the context of balanced reasoning if used selectively (e.g., some arguments are refuted but others, on both sides, are weighed or synthesized)" (Nussbaum 2008, p.551). Combining the two strategies was not explicitly instructed during the training session. However the diagram method introduced both a weighing feature, by assigning strength on textboxes, and refutation function, through using colour.

Through comparing the first and the second essay both participants conclude to that, on balance, their first one was better. Deana finds working her plan on paper difficult. It took her more time to plan with the diagram and a lot of effort to neatly position the text in boxes. She thinks that additional effort is needed to avoid having a 'messy diagram'. As result of extensive diagramming she ended up with more content on the plan which she did not include in the essay as she thought it was irrelevant to the topic. This made her see that her first essay was more to the point. Liana did not enjoy using the method either, she found the diagram

confusing and difficult to follow during writing. Liana explored her argumentation in depth but in doing so she thought that the diagram did not help her to overview her position. She did not know how to deal with non-refuted counterarguments. Furthermore, in order to deal with the complex structure of the diagram, including many links and boxes, she had to develop her ideas significantly more in the essay.

> Interviewer: Oh, I see. How do you think the diagram acted, I mean was it good or more confusing?
> Liana: It probably meant I had to expand on some bits, but in some ways it was a bit more confusing when I went to write the essay, because I ended up like I'd use a point but then I'd go off a bit more. Because I didn't just stick to what was on the diagram, there was other things as well.
> Interviewer:: Why was that, was it difficult to see?
> Liana: I think it sort of made it a lot more bity, there were lot of different points I was making in one paragraph rather than just carrying on with one point.
> Interviewer:: So the way you did it there on the map, it didn't help you to see how to structure it?
> Liana: It helped me to see the next bit I was going to write, but each bit was not necessarily as connected, so each bit sort of created a new thing to talk about. So I ended up expanding it quite a bit, but I don't know whether it linked very well.

It is noteworthy that Liana and Deana perceive some aspects of the diagram usage as awkward or problematic, but these could also be seen as triggers of reflection on the content and even knowledge transformation. For example, as in the quotation above, Liana describes that she had to elaborate further on the textboxes and links while writing. Although this is not perceived by her as an advantage, transforming or expanding the plan structure, may be in many cases a knowledge transforming activity. Similarly, Deana's extensive planning and selection of relevant content is a reflective activity, common in the cycles of planning and revising. Indeed Deana acknowledges that the use of colour made her interact more with the diagram, motivate her to refute counterarguments, and develop the diagram so that branches are developed 'evenly' on both sides.

The benefit perceived by using the method is rather small. Deana acknowledges an advantage in using the method during linearization and paragraphing. Emerging themes and the

representation of argument orientation with colour helped Deana to define the order of paragraphs and to improve the flow of text. The main benefit for Liana is that working with the diagram helped her to become more aware of the argumentative moves she is making.

It cannot be argued, given the evidence form the interview, that the two participants advanced their awareness regarding argumentation. The use of the diagramming method exposed the participants to two comparisons on which they reflect: First, a comparison between the two essays and, secondly, a comparison of two integration strategies. However they could not see the value of engaging with the diagram or the scope of the refutation strategy in strengthening a position. This implication may be interpreted through two perspectives. First, constraints inherent in designing the diagram on paper, such as the size of the paper, the messiness of handwriting, or correctly applying the colour on the diagram, may impede the participants from understanding the semantics of the diagram. Second, the resistance of the participants towards refutation is more likely to be explained by the resistance to adopting a new argumentation strategy and the limited self-monitoring capability that characterize unaware participants.

6.6 Synthesis

There is very little evidence amongst the 16 participants indicating that synthesis schema is used. In this schema the writer or arguer integrates arguments of both sides in a compromise position. Such an approach is taken when the writer sees the plausibility of more than one position regarding an issue and defines under what conditions the writer would adopt them. Then a "creative solution is taken in which benefits are realised while disadvantages are minimized" (Nussbaum 2008, p.551). In this sense, refutation and weighing strategies may also be employed in the synthesis schema, to reason at the level of individual arguments.

6.6.1 Synthesis and aware-and- oriented as initial schema

Billy's interview is the only one where some evidence of synthesis may be identified, albeit described briefly. The participant is not very thorough when reporting about his writing process. He gives a brief account about how he analyses the topic in more than one assertions and supports both of them.

> Interviewer: Which one did you find more difficult to tick of these during planning?
> Billy: I think "do I take a clear stand at debate", because I could see both sides of the argument and that's kind of what I concluded on, because I was thinking, building relationships you can just have in different ways, you could think of it as kind of start a relationship or like developing existing one, so I kind of had a different view point for both of those things.

In this quote, Billy appears to be not only aware of a difficulty relevant to the argumentation schema but also able to give an explanation for this difficulty. Billy is also reporting about developing his points in depth being difficult. Contrary he identifies as strength his ability to develop multiple points and to always take into account the opposing view.

Billy values the process of planning for allowing him to formulate his position and for facilitating writing. He believes that once arguments are thought through and has a good understanding of his position then the writing is much easier. Billy develops an outline with

bullet points, tries to establish links between the points, and, before starting writing, reflects on how he will prioritise them. He also reports about using the refutation strategy without difficulty. However, there is no extended account in his interview about how he employs the refutation strategy.

Characteristics of synthesis: aware-and-oriented PRE and POST			
Billy	**Knowledge of ability**	**Knowledge of schema and strategies**	**Implementation & evaluation of schema and strategies**
PRE	Difficulty with taking a clear stand, more than one assertions contribute to position (synthesis schema) Difficulty with developing points in depth Strength: anticipating opposing arguments	Plans with bullet points, associates points together, and prioritises Planning provides a space of reflection where a position is formed	Planning is more difficult than writing. Once ideas or arguments are planned writing is easier
POST	Difficulties reported are related to implementation of the method.	Advancing counterarguments to supporting arguments and subsequently refuting them contributes to better quality argumentation Position defined before starting planning	Software helped to develop points in depth Visualisation of a argumentation contributes to better organization of the essay. Diagram did not contribute to idea invention more than usual planning method More difficult way to organize argumentation, more time consuming Switching between diagram and word a bit distracting; copying and pasting was useful.

Table 6.25: No progress of the computer user after using the method on computer

Billy appears to be a confident writer, who is also aware of the difficulties he usually encounters during writing. Very few comments are elicited during the interview about how he employs the refutation strategy, however the participant reports no difficulty with refutation. He has a rather good understanding of the planning process and the argumentation schema he adopts. Awareness of cause or implication of difficulties and familiarity with integration strategies, such as position formulation during planning and refutation, are characteristics of the aware-and-oriented category.

6.6.2 No change in awareness for synthesis participant

Billy is already at the most advanced level of the proposed framework, as this is defined by the two parameters: argumentation schema and level of awareness of argumentation schema. There is not enough reference to confirm that Billy adopts the synthesis schema in the second essay. He continues to employ the refutation strategy and believes that learning to employ refutation in the supporting side of his argumentation is a great benefit. Regarding his experience with using the diagram method on computer he identifies many benefits but also few problems. However, he does not give a comprehensive explanation about either of these.

In the first essay, Billy refers to refuting counterarguments to his position without any difficulty. In the second essay, Billy widens the use of the refutation strategy, and integrates refutation in both sides of his position. He challenges arguments that support his position with counterarguments and subsequently refutes them.

> Interviewer: So if you compare your essay yesterday and today you what would you have to say?
> Billy: I would say I think I counter-acted and refuted my positive arguments as well which you suggested earlier.
> Interviewer: Do you think that was effective for your text, or was it making it more confusing?
> Billy: I think the way I did it this time probably made my arguments more convincing by considering the whole picture more.

Such use of the refutation strategy is considered an integration strategy. On the other hand, Billy reports that in the second essay he decided on his position right from the beginning, implying that he did this without relying on the interaction with the diagram to formulate his position. Further investigation into his process and essay text is needed to confirm whether Billy used less integration strategies in his second essay.

Finally, Billy considers that using the diagram method helped him to think more about the quality of his arguments. The visualisation of argumentation structure on the screen contributes to better organization of the essay. He also reports that he worked on refining the content of the diagram after he copied and pasted onto text. It is not specified if he used the feature of automatic outline. In general, he is not sure he would use the software again, especially if he had to work with time constraints. Interacting with the diagram encouraged invention of ideas but only as much as his usual method. He considers the computer-based diagram a difficult way to organize argumentation, more time consuming than his usual planning process. Nevertheless, he suggests that he could apply the rationale of diagrammatic representation on paper, especially if he is writing for an exam.

It cannot be excluded that Billy has reverted to reducing the use of integration strategies, such as less reflection on the formulation of position. This may be the result of using the method or of the topic itself, assuming that Billy had a firm position from the beginning. Comparison of his actual planning process and text, before and after using the computer-based method, will shed light to whether the use of the method had an adverse impact. Overall, there is little improvement in Billy' awareness about the use of argumentation strategy. This may well be explained by being already categorised at most advanced level of the framework.

6.7 Conceptual framework

Argumentation schemata encompass knowledge that the writer retrieves when engaging in specific goals, processes and strategies of writing. The analysis of the interview transcripts resulted in two dimensions through which we can observe the change of participants' argumentation schema. The first dimension is the *representation of argumentation schema*. Earlier this thesis presented four argumentation schemata: myside bias, pseudo-integration, integration, and synthesis. Arguers progress within this range of schemata, i.e. within MSB and synthesis, as result of instruction of in argumentation strategies and process, such as the diagrammatic method.

Figure 6.4: Range of argumentation schemata progressing from MSB to Synthesis

The interview analysis investigated the participants' perception about the argumentation schema they usually use, the perceived limitation of the schema in use, how they think a more advanced schema should be, and the difficulties the participants face when trying to implement the more advanced schemata. This leads to the second dimension, the participants' *awareness about argumentation schema*. Depending on their level of awareness the participants may disregard the need to improve their schema, lack knowledge of required processes, or need further skills in order to implement more advanced argumentation schemata. Three levels define awareness about argumentation schema: unaware, aware-but-lost, and aware-and-oriented.

Unaware: They appear unaware of the argumentation schema limitations and do not sense the need to change it. The difficulties they report about writing argumentative essays are not relevant to argumentation schemata or argumentative text processes. The participants appear confident that the current schema is the appropriate argumentation schema to employ.

The unaware participants ignore or resist to the knowledge that a more advanced schema may be required.

Aware-but-lost: The participants appear critical about using the current schema by referring to its limitations and thus gradually becoming aware of the need to improve. However, they are not quite clear about the implications of these limitations and thus they are not very conscious of the need to adopt a more advanced schema. They lack in knowledge about the practices and strategies required by a more advanced schema. They report specific difficulties in employing the more advanced schema.

The aware-but-lost participants know that they should improve their schema but do not know how.

Aware-and-oriented: As in the previous category, the participants are critical about using the current schema. They have a better understanding of the need and reasons why they should improve their schema. Nonetheless they may still encounter difficulty when they try to implement the process of a more advanced schema. In this category, participants have a first understanding of the process of implementing the more advanced schema. However, they lack the skills for self-regulating the implementation of the process. For example they may conceive the process of integrating arguments with counterargument but lack in the linguistic skill for conveying this complex structure in the text. Regulatory skills also include resource planning, e.g. how much time they should allocate to organizing their thoughts before

writing, and managing processes, e.g. deal with cognitive overload caused by simultaneous argument invention and argument orientation.

The aware but oriented participants know how they could improve their schema but have not mastered all the skills needed for implementing this improvement.

Unaware	**Aware-but-lost**	**Aware-and-oriented**
Unaware of the limitations of the current schema	Criticize current argumentation schema	Criticize current argumentation schema
Known weaknesses not relevant to argumentation schema	Some understanding of the process required by a more advanced argumentation schema. Advanced strategies perceived as difficult.	Understand the process required by a more advanced argumentation schema
Confident about implementing current schema	Sense the need to improve to a more advanced argumentation schema	Lack in skills, such as self-regulatory skills, required for implementing the more advanced argumentation schema.

Table 6.26: Main characteristics of 3 level of awareness

6.8 Overview of results

The two dimension, representation of argumentation schema and awareness of argumentation schema, define, first, a variation between participants before being introduced to the diagramming method and, second, a variation of improvement in awareness after they used the diagramming method (Table 6.26). Figure 6.5 depicts the 4 argumentation schemata on a continuing zone over four rows. The progress is visualised from the bottom row, myside bias, towards the upper rows, progressing from left to right.

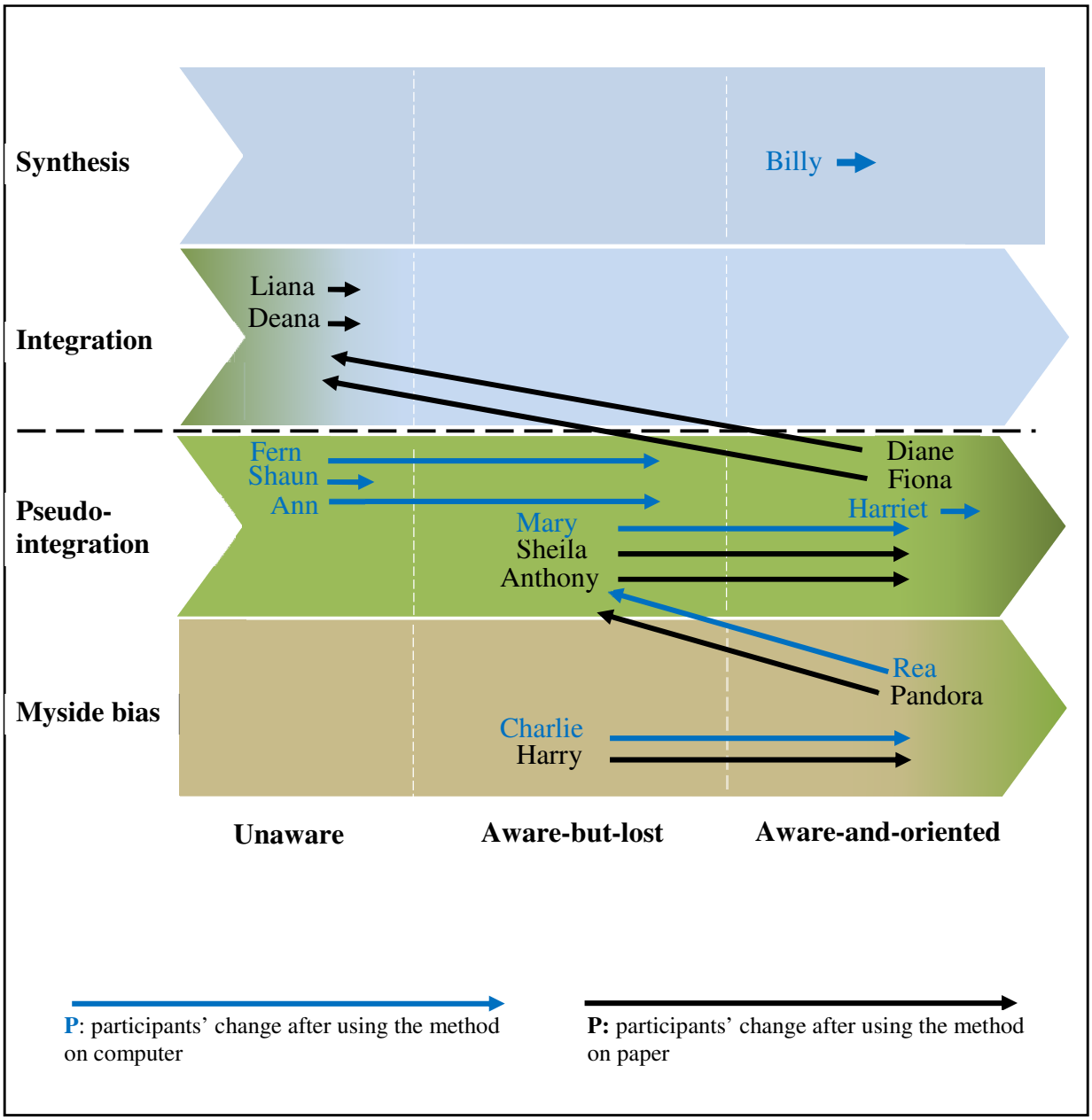


Figure 6.5: Results overview graph

The 3 awareness levels are represented by 3 columns and correspond to 3 progressing positions, from left to right, on each argumentation schema row. In the schematic representation (Figure 6.5), the least improved position would be at the bottom left myside bias / unaware. The most improved would be the top right, synthesis /aware-and-oriented.

On the same figure each participant is symbolized by an arrow, representing the shift or improvement of the participant's schema from pre- to posttest interview. The blue arrows

represent participants, who used the diagramming method on computer, while the black arrows those who used the method on paper. The longer and medium arrows represent a major and minor shift. The short arrows indicate lack or minimal shift. Notably a major shift characterises participants Rea, Pandora, Fiona and Diane, who progressed on to a more advanced argumentation schema. The rest of the participants either improved in awareness of argumentation schema (e.g. Charlie, Harry) or did not improve at all (e.g. Shaun). .

The current study informed our understanding through self-reported accounts of the planning and writing process. More standardised methodological tools, e.g. questionnaires, may have elicited data without the direct intervention of the experimenter. Interviewing the participants twice may have in itself raised their awareness about their strategies and processes. Another limitation of the study is that the participants' were coming from a variety of disciplines making difficult to control extraneous factors that may affect their representation of argumentation schemata, such as genre requirements and previous instruction in academic writing. A following up test would give us a better understanding confirming whether the participants, especially those who have improved to a more advanced schema would retain this effect. Operationally, indications that people possess an abstract schema include (a) appropriate use; (b) variation in surface form while preserving deep structure; (c) repeated use, especially use over an extended period of time; and (d) use in varied contexts (Anderson et al., 2001).

Chapter 7 Conclusions

7.1 Response to Research Question 1: Argument Diagramming and the quality of argumentative essay

The first study of this research aimed to investigate the impact of argument diagramming on the quality of argumentative essays to complement the limited number of studies which have looked into this issue either as computer-based method (Erkens et al., 2005; Lin et al., 2004; Okada, 2008; Suthers et al., 1997) or as paper-based method (Nussbaum, 2008; Nussbaum & Schraw, 2007; Yeh, 1998a). The following research question was set up:

RQ1. Does argument diagramming administered as a paper-based and computer-based method improves significantly the quality of argumentative essays?

Two hypotheses were developed to explore this research question:

Hypothesis 1a*: The use of computer-based Dialectic Method, as a method of supporting the planning and writing of argumentative essays, improves significantly (i) the overall quality and (ii) the argument structure of argumentative essays.*

Hypothesis 1b*: The use of paper-based Dialectic Method, as a method of supporting the planning and writing of argumentative essays, improves significantly (i) the overall quality and (ii) the argument structure of argumentative essays.*

In order to explore these hypotheses two studies (study 1a and study 1b) were set up with non-random allocation of groups. A Dialectic Method (DM) was devised as a method of supporting argumentative writing using argument diagrams. The method was administered as a computer-based method (Computer DM) and as a paper-based (Paper DM) in order to scaffold the planning of argumentative essay.

The comparison between baseline and posttest results of the group who used the computer-based argument diagramming method confirmed Hypothesis 1a (study 1a). The group using the Computer-based DM produced essays of significantly improved overall quality while these essays included significantly more refuting statements. The confirmation of Hypothesis 1a demonstrated the significant increase in refutation strategies of the computer group, but it was not clear whether this increase was the result of the medium used (computer-based DM) and/or the result of the low starting point in terms of argumentation skills. Moreover it was not clear whether the adoption of more refutation strategies by the computer group included just the increase of number of refuting statements and/or the increase of the depth of the refutation statements. Hypothesis 1b was not supported by the statistical analysis.

A number of valuable insights have been gained from this study. Firstly, the study has highlighted the difference between the overall quality of an essay and the argumentative quality of its text. Although the argumentative quality may influence the overall quality (and vice versa), the two concepts should be treated as conceptually different. The two constructs need to be treated as distinct items of the research agenda while different sets of research tools and research strategies need to be developed to assess them.

Secondly in line with a number of other studies (Erkens et al., 2005; Lin et al., 2004; Okada, 2008; Suthers et al., 1997) the improvement of argumentative writing was identified in terms of counts of argument structure components such as counterarguments and refutation. However this study has drawn attention to the fact that research should expand into how the argumentative components relate to each other and how they are integrated into a coherent argumentative essay.

Thirdly, the study has also demonstrated the importance of the argumentative ability of writers as it creates the base where argument diagramming is called to ‘function’ and make a

difference. This is in line with a number of authors who argued that as writers adopt more complex argument structures, the quality of argumentative writing may deteriorate, especially amongst learners of low argumentative writing ability (Coirier & Golder, 1993; Golder & Coirier, 1994). In fact it is the interaction of writers argumentative ability with the affordances and the capabilities of the (argument diagramming) method that produce the final impact on the quality of the written essay. It is very difficult to assess the impact of argument diagramming method on the quality of argumentative essay without considering the way the method was used and perceived by the writer.

Fourthly, it highlighted the need to explore the cognition process underlying the interaction between argument diagramming and the writer. In other words it is important to explore how the argument diagramming method is used by different writers (or writers with different abilities) as well as the changes in argumentative writing processes induced by the use of argument diagramming. Both are expected to impact the quality of argumentative writing. So only a few studies have investigated how argument diagramming affects the process of writing and in these studies the participants were engaged in collaborative argument diagramming (Erkens et al., 2005; Suthers et al., 1997).

As a contribution towards these research objectives Study 2 was set up to focus the writing cognition process and its meta-cognitive aspect. An important consideration for this study became the level of argumentative writing ability of the writer and how it relates to the argumentative writing processes and the use of argument diagramming.

7.2 Response to Research Question 2: Argument Diagramming and the writing cognition process

The results of study 1a and study 1b have generated the motivation for examining the impact of argument diagramming on writing cognition. The following research question was set up for investigation:

RQ2. How does argument diagramming as a method of supporting the planning of argumentative essays affect the cognition of argumentative writing process and the quality of argumentative text?

Writing cognition is defined in this thesis as the cognitive *processes and strategies* that can be inferred through observing the writer and analysing intermediate and final writing products, such as plans or drafts and final texts. In response to this research objective, process data were collected from 16 participants who applied argument diagramming as a planning method of writing and compared with data collected while they were applying their usual writing process and strategies. The essays were analysed using an in-depth approach that assesses the coherence of argumentative text, and in particular aspects pertaining to the semantic and rhetorical structure of argumentation. According to these aspects of text quality each participant was characterised by a predominant argumentation schema, i.e. myside bias, pseudo-integration, and integration synthesis. This argumentation schema continuum as well as rhetorical aspects and issues of text define the argumentative writing level of participants. The process data (including think aloud protocols, screen recording, hand-writing recordings, and plans) were analysed in order to identify reasons and mechanisms behind critical improvements in the essays written with the scaffolding of argument diagramming.

Three groups of important insights were gained through this study: (i) the impact of argument diagramming method on writing cognition per level of argumentative ability of the writer (ii)

the representational strengths and weaknesses of argument diagramming, and (iii) a group of insights about the way the implementation of argument diagramming affects different writing processes in argumentative writing.

Firstly, a critical factor influencing the way the argument diagramming method affects the writing cognition is the level of argumentative ability of the writer. Writers with lower argumentative ability gain more from the method than writers with higher ability.

Engaging with argument diagramming method is beneficial for writers of lower argumentative ability, although some semantic or rhetorical problems persist

Writers with lower argumentative ability have gained a lot from the engagement with the method. In fact writers at the lower level of argumentative ability are the higher beneficiaries.

As a result of engaging with argument diagramming, writers at the lowest level (my side bias) achieve a better performance in terms of semantic 'content' (e.g. better balance between supporting and counter arguments, increase refutation content and reduce weak refutations) but they still face problems with more complex structures (e.g. complex refutations and argument-position coherence). At the next level of argumentative ability (low level of pseudo integration), writers gain not only in terms of semantic 'content' but also how to start including conciliatory integration strategies (e.g. weighing and weighing minimization) and how to handle better more complex argumentative structures. Writers at the following level of ability (middle level of pseudo integration) use argument diagramming to learn how to form more sophisticated positions, i.e. positions with qualifications or composite positions with a number of nuances (synthesis contingent positions) as well as how to combine this sophisticated analysis with the essay position.

In terms of rhetorical benefits, writers at the lowest level of ability seem to improve the thematic continuity of their essays, and reduce digression and repetitive and unclear

statements. Writers at the lower end of pseudo-integration achieve deeper development of paragraphs and statements but they suffer from increased digression and unrelated statements; probably the price they pay for learning to develop in more depth their arguments. However writers at this level experience problems with some of their weighing attempts which end up as juxtapositions rather than weighing. The argument diagram method helps writers at the middle level of pseudo integration to distinguish juxtaposition from weighing. They also improve the relevance of the content although some increase in digression and unclear statements are still observed.

The needs and the requirements of writers at higher levels of ability are sophisticated and not always successfully met by argument diagramming

At high levels of ability, the writer's needs are more sophisticated while their expectations for 'return on investment' (in terms of their time and effort) are much higher. However, the affordances of the argument diagramming tool are not always responding to their needs and expectations. In fact the higher the ability of writer, the more sophisticated processes she expects from the argument diagramming method. For example, the writer at the high level of pseudo integration, who expected a synthesis-contingent approach to be represented with the argument diagramming notation and she gets disappointed when she realises that this is not the case.

The results of engaging with argument diagramming become rather mixed among writers with some strength in their argumentation schema (high level in pseudo integration). In fact argument diagramming had in general a rather negative impact on the semantic aspects of their essays. The most harmful effect of the method is the retraction from the development of refined positions with various degrees of nuances (i.e. positions with qualifications or contingent positions) to simple 'black or white' positions which adopt a less sophisticated stance in the question under investigation. Argument diagramming also causes writers at this

level to narrow down their integration efforts to mainly refutation, reinforcing the adversarial aspect of their strategies. The argument diagramming method is more beneficial in terms of rhetorical aspect of their essay where things like the thematic connectivity, the development of their statements depth and the relevance of content improve. On the other hand argument diagramming is unable to help with more complex rhetorical tasks like the expression of long and difficult chains of counter and refutation.

As far as the writers at the highest levels of ability (integration and synthesis), although some gains are demonstrated, in the main the impact of argument diagramming is rather limited. Writers at the lower end of this level seem to gain how to advance their weighing strategies by basing them on deep refutations and more conciliatory ("more mellow") statements. However writers at the high end of integration schema seem to be destructed by the implementation of the argument diagramming method by 'sliding' towards less integrative positions, retracting to adversarial strategies and condensing the depth of their arguments. In rhetorical terms, writers at the lower end of this level acquire a more sophisticated thematic flow and eliminate unclear passages between paragraphs. Nevertheless the rest of the group slide back to juxtaposition and weaker thematic flow.

Secondly, this research has also enabled a number of insights about the representational strengths and weaknesses of argument diagramming.

Argument diagramming is very effective in motivating writers to increase refutation

Irrespectively of whether writers were of lower or higher argumentative ability, the engagement with argument diagramming has consistently delivered an increase level of refutation activity in the writing cognition process. Counterarguments and refutation are the most salient elements of the diagram. Refutation EDUs and refutation moves increased

constantly in the argument posttest essay. This is line with the results of studies 1a and 1b which showed a significant increase in the refutation of posttest essays as well as other studies (Nussbaum & Schraw, 2007; Yeh, 1998a).

Refutation was increased even in the group of writers on the highest level of argumentative ability, albeit sometimes with useful effects (e.g. weighing strategy based on deep refutations), sometimes with destructive implications (e.g. retraction to adversarial strategies such as refutation without weighing). Conversely writers at lower levels of argumentative ability gained a lot from incorporating refutation in their writing cognition, delivering, as a result, more integrative essays.

The impact of argument diagramming on the quality of the essay is becoming even greater when the method is used not only to increase the refutation content i.e. EDUs and moves (usually as part of the planning process) but also to increase the quality of refutation statements, generating deeper and stronger refutation. This impact takes place when the argument diagramming is used as part of the linearization process, where the writer combines the refutation content generated during planning with elaboration and reflection supported during linearization.

The argument diagram conveys the adversary strategies as the most salient argumentation strategies while the conciliatory strategies can become salient mainly when a position deliberation approach is taken.

Argument diagramming notation may support the representation of weighing strategies

The analysis showed that writers who engaged in position deliberation through diagramming were more likely to include weighing strategies. The process analysis showed that visualising the connection of a supporting and counterargument textbox, without the counterargument being refuted, motivated the writer to translate this visualisation into a weighing or weighing-

minimization strategy. Writers with low argumentative writing abilities have indeed benefited a lot from the use of argument diagramming in the sense of acquiring representations for a weighing and weighing minimization strategies.

This is partially in line with what Nussbaum and Schraw (2007) research who have found that a similar argument diagram increased adversarial strategies. However, this can also be explained by the fact that in their studies the students planned for 5 minutes and they did not have access to plans while composing. The writers in study 2 were constantly looking at the diagram while translating. Another reason may be that the writers in Nussbaum and Straw's study were of high argumentative ability.

Argument diagramming is not flexible enough to respond to a changed position

Argument diagramming is successful in supporting the deliberation and formulation of a position. However, if the writer perceives that the position she explored tentatively is not true, i.e. the writer perceives that the invented argumentation cannot defend the position, then argument diagramming becomes unfit and especially problematic in supporting the translation process. Writers came to the need to 'invert' position while using the diagram on paper and on computer. None attempted to reorganise the plan to fit the new position, neither on computer nor on paper. Both the system and diagram are viscous to adapt to the revised position and inverting of argument orientation. The impact on the remaining process is rather destructive with the writers having to put extra effort to pursue further the writing cognition process.

Argument diagramming cannot represent conciliatory positions such as the position with qualifications or the synthesis position

The role expressiveness of argument diagramming is limited in supporting the development of more sophisticated positions, namely refined positions with various degrees of nuances

such as the positions with qualifications or contingent positions. As seen very clearly in the case of writers at the high end of pseudo integration, argument diagramming encourages the adoption of more 'black or white' positions with arguments flowing out of it in a hierarchical way. This is definitely damaging for the very purpose of integrative argumentation, where the dialogue between different perspectives is a principal aim.

Higher ability writers may conceive and formulate at a very early stage of the planning process a synthesis contingent position. Their emerging need is then to use argument diagramming in order to analyse, establish and confirm this position. Nevertheless the diagrammatic notation of the method does not allow the representation of a synthesis contingent position at the top level (contention) textbox. Including more than one claim in the contention textbox would cause insurmountable ambiguity in the diagramming process. The alternative solution of visualising the conditional part of the position with a sub tree of the diagram may be theoretically considered, however it has not been empirically.

Thirdly a group of interesting insights concerns the way the implementation of argument diagramming affects different writing processes in argumentative writing.

The support of planning processes through argument diagramming affects mainly semantic aspects of text while the support of linearization processes affects mainly rhetorical aspects

Argument diagramming has been found to facilitate all writing processes: planning, linearization, interleaving and writing. This research has found evidence of higher impact of argument diagramming on planning and linearization (although this is in line with the main focus of this study). For example, when argument diagramming supported the process of position deliberation during the building of argument diagram then a planning process was involved; when the participant organised the content of diagram trees in paragraphs then linearization process was involved. Overall, the semantic structure parameters of text, for

example increase of refutation strategies or elimination of weak refutations, were affected through the use of argument diagramming in the planning processes and to a less extent by the use of the method in the linearization processes. In contrast, the rhetorical structure changes, for example improvement of development in depth, were mainly affected by the use of argument diagramming in the linearization process and to a less extent in planning process.

Argument diagramming can respond only to a degree to linearization since it falls short of responding to high order requirements of the linearization process

Functions such as content evaluation (assigning strength to textboxes) and content selection facilitate the linearization process: relevance of content is reviewed; themes emerge from argument trees; argument sub trees are organized into paragraphs and prioritized in the order of text presentation. However, appropriate sequencing of textboxes in linear text, elaboration of content, and appropriate linguistic enhancement is needed form the writer in order to complete the linearization process. The sequencing algorithm of the computer linearization is not sophisticated enough. The user does not have control over the linearization algorithm rules.

Argument diagramming can change the nature of planning and linearizing, if applied with a semantic association intention in mind

Argument diagramming prompts a more structured approach to planning and translation. In particular it streamlines erratic approaches to planning, i.e. adding textboxes as they come to mind, aiming for content generation mainly, applying mechanically content association, shifting unpredictably from one part of the diagram to another, in a ‘knowledge-telling’ kind of way. It can also systematise the linearization process by prompting writers to engage in longer and uninterrupted sessions of organising sub trees in paragraphs, elaborating on the content, and linguistically encoding them in coherent paragraphs. Improvement of rhetorical structure issues, such as flow of text, relevance of content, development in depth and

juxtaposition, are the outcome of *combined* streamlined planning and systematic linearization.

If argument diagramming is not used with the intention to either semantically associate arguments, or to systematically translate content, then the benefit on process are less pronounced.

Argument diagramming appears to influence a linear rather than iterative process between planning and translating.

Planning and translating are known to be iterative processes. Analysis of the baseline essay writing process has shown that all participants start with planning on paper, even with a limited time of two to three minutes. Three of the participants returned to the 'drawing board' to draw plans that would help them to deliberate on their position or summarize their thoughts before resuming composing. The majority of participants followed -more or less - closely their notes and plans while composing. While composing the majority of ideas and arguments were added straight to the text on the computer screen and not on paper. There is little evidence showing that writers engage in several iterations. Time constraints is probably not the reason as most of the participants did not exhaust the time that they were given.

During argument posttest essay there is even less evidence of interleaving writing and engaging in iterative processes of planning and translating. Adding one or two textboxes while composing was scarce and, when it was noted, it did not impact the structure or position of text. As in the baseline process, the writers used the diagram to 'deposit' a thought as a reminder. They did not interleave the composing task to engage in new lines of argument and counterargument. First, this should be explained with reference to the result regarding the weak representational strength of argument diagramming and changing of position. Writers who change position after diagramming did not revise the diagrams. They probably

appreciated that it would be too much work for little return to create a new diagram. Second, such iterations are more likely to happen in written projects of longer length and impact, e.g. dissertations or term papers. Finally, iterating planning and writing is a characteristic of expert and professional writers.

The differences of the impact on the cognition process between the paper-based and the computer-based method were also explored, whenever this was possible, and the following trends were made:

As far as the difference between computer and paper is concerned the investigation did not find important differences in the impact of argument diagramming. No patterns are identified in the processes associated with semantic or rhetorical change that point to benefit or harm from either the computer or the paper argument diagram. Diagrams produced on paper were no better than those produced on computer and vice versa. Inventing content or establishing sound links between textboxes is not affected by the medium.

The analysis of the baseline essay process has shown that writers have their own ways of planning on paper, using rough sketches, expanding on more than one page, and sometimes employing sophisticated methods with numbers, and arrows. Planning on paper comes naturally to them. Fewer participants started their planning directly on computer, while some who started on paper opted to transfer and even transform handwritten notes to the screen.

While there is no evidence suggesting what is the best way to apply argument diagramming observing writers at task has led to identifying strengths and weakness of either platform.

Applying argument diagramming on paper has shown that it allows interactivity. It allows writers to annotate diagrams with informal marks indicating, for example, the order of the paragraphs. An advantage of working on paper is that it enables to simultaneously view the diagram and the screen. Combining the paper diagram and the screen provided the best overview for linearizing the diagram. In contrast, an important weakness of argument

diagramming on paper is that it can be very messy. Hand drawing and arranging textboxes and links is not always done tidily. This may restrict the visualisation of tree formations and the overview of position and argument orientation balance. However, this was seen mainly amongst the low ability groups.

On the other hand, argument diagramming on computer allows to better visualising the structure of the diagram. It is also much easier to rearrange textboxes on the screen and edit text. Working on the screen imposes no limit on how many textboxes one can add to expand the diagram in depth or in breadth. A function of the computer-based diagram that has proven to be controversial in this study is the automatic outline function. On one hand, many writers took on happily to use this function, while other showed difficulty while working with it.

The automatic linearization function of the computer-based argument diagramming does not benefit the linearization process. (The function of copying and pasting the diagram activates a linearization algorithm that constructs an outline upon pasting of the diagram.) Writers' responses were mixed however. Some writers, in particular those in the lower levels of ability, appreciated the value of easily transferring content from the diagram into text by simply copying and pasting. Out of these writers, those who elaborated on the 'pasted' content produced well developed paragraphs or essays. In contrast those who relied too much on the linearization algorithm and did not edit or enhance the diagram content produced 'plastic' text that did not flow naturally. Writers from higher ability group criticised the automatic outline function stressing that progressing from one planning stage to another requires transformation of content. Furthermore, changing the diagrammatic representation into a linear one automatically, without the user being engaged, requires from the writer to establish a new visual and semantic relation with the automatically produced diagram.

7.3 Response to Research Question 3: Argument Diagramming and the writer's planning metacognition and regulation of pre-writing strategies

The way the writer perceives argumentation and the extent to which she is aware of her own strengths and limitations are important factors determining the impact of argument diagramming on argumentative writing. As a result the following question was set up:

RQ3. How does engaging in argument diagramming as a pre-writing strategy, on paper or on computer, affect writers' metacognitive awareness about argumentative writing?"

Argument diagramming helps to bring together representations of planning and writing with representations of argumentation formulation. The analysis of the interviews showed that the participants talked about planning strategies without referring to argumentation formulation in the baseline interviews. The reported planning activities referred to semantic associations of points and ideas, for example, spider diagrams, random lists or 'for and against' lists, but without paying attention to argument formulation issues, like position formulating and counterargument integration. Nevertheless, when asked about argumentation formulation, the participants were aware of argumentation formulation difficulties or processes. In the posttest interviews, accounts of planning and linearizing included argumentation formulation goals. Moreover, in the posttest interview the participants realised that, in comparison to previous practices, they started taking into account argumentation formulation goals.

The diagram method contributes to improving awareness of argumentation schema for participants who start with less advanced argumentation schema (low argumentation schema baseline). Conversely, participants who report about implementing integration strategies, i.e. they are classified under the integration and synthesis schema (high baseline), do not perceive that they have improved a lot their argumentation strategies. In addition, the lower the baseline, the more unified benefit the participants perceive, irrespectively to whether they use

the method on paper or on computer. The participants in the myside bias perceive the diagram method positively, whether using it on computer or on paper. In the middle baseline level, i.e. in the pseudo-integration schema, using the computer method introduced many challenges and does not always improve awareness.

Interacting with the argument diagramming method improves participants' awareness of argumentation goals and processes, taking them through three levels: unaware, aware-but-lost, and aware-and oriented. The last level, aware-and-oriented, denotes the highest level of metacognitive awareness in this scale. The participants who started from this high level of metacognition, advanced in argumentation schema, not only in awareness. At this level participants benefit from an increased ability to planning and monitoring the task, and self-regulate difficulties. In the baseline interview, they were aware of the difficulties but also of the causes and impacts of these difficulties on their argumentative texts. After using the method all 4 share two main characteristics in the way they reflect on their current and older practice. First, in their accounts they compare the new processes, introduced with diagramming, with older practices and identify the benefits of the new ones. Second, all 4 realise that most of the difficulties they encountered are met through using the diagrammatic method.

The participants who improve in awareness of strategies, but do not gain in progressing to a more advanced schema, they do so following a gradual, stepwise manner rather than overarching leaps. The analysis has identified two important steps: the improvement from unaware to aware-but-lost and the improvement from aware-but-lost to aware-and-oriented. In the first one, in the improvement from unaware to aware-but-lost, the participants are sensitised to the limitations of their argumentation schema and may discover also the cause or impacts of the difficulties. Furthermore, they also activate implicit or latent knowledge about

argumentation structure. The latter is in line with other studies that examined the impact of graphic organizers (e.g. Felton & Herko, 2004). Activating existing knowledge may come as result of revising misconceptions related to misunderstood genre requirements. For example, Fern, who was already familiar with the refutation strategy from her debate club, in her baseline believed that this is not an appropriate argumentative writing strategy, but then, in the posttest, she revised this belief. The second step, the improvement from aware-but-lost to aware-and-oriented, is characterised by gain in knowledge of argumentation strategies, effectively implementing more advanced strategies. However, implementing more advanced strategies is met with further difficulties, resulting from increased complexity of formulated structures. More complicated schemata, include more 'slots' or 'stratagems' and hence require more cognitive effort (Wolfe et al., 2009, p.185). Furthermore, an important gain of advancing to aware-and-oriented is that the ability to monitor and self-regulate the implementation of a more advanced schema increases. At this level the writer is more able to evaluate his or her goals and strategies or even set new challenging goals.

In terms of comparing argument diagramming on computer and on paper, the computer appears to present more challenges to the user. This may be caused by the additional cognitive effort needed for learning to use the software but also by features, such as the automatic outline function, which may have caused disruption and are criticised. Interestingly, all participants of the middle zone, the pseudo-integration schema, expressed some criticism about using the method on computer. On one hand, using the method on paper may cause less interruption, making it easier for the user to engage in the argumentation formulation process. This may create higher awareness of the process and better articulation of the achieved improvement. On the other hand, using the computer may cause initially less satisfaction, caused by the required learning effort and usability challenges, but the cognitive burden does not necessarily obstruct improvement.

7.4 Theoretical re-considerations

Argumentative writing is a very complex task relying on (a number of) complex processes. Writing ability in the argumentative genre necessitates ability in argumentative thinking and ability in conveying this thinking in coherent written discourse. Each of these abilities encompasses a great deal of knowledge and strategies in order to conceive and deliver argumentative text.

Argumentative thinking draws on mental representations build in human beings, both developmentally, but also through a social and historical construction process. Argumentative thinking starts to develop from an early age in individuals and may continue to develop beyond maturity through education and personal development (Golder & Coirier, 1994; Kuhn, 1991). People draw on socially constructed argumentative schemata, such as the ability to dialogue, the ability to express one's own position and listen to other people's view and, crucially, the ability to evolve one's own views and knowledge through this process. Many refer to these processes simply as learning or more specifically arguing to learn (Andriessen et al., 2003).

Within the argumentative genre, writing necessitates the skill to communicate ideas in such a way that readers follow a clear and constructive dialogue between views but also hear the writer's voice. In this dialogue, the writer's voice may take an oppositional tone at times, arguing in favour and against positions and forwarding and defending strong beliefs. Supporting, countering and refuting arguments take place in this dialectic process. However, argumentative writing may also -and should- accommodate a synthesis of positions along the integration of arguments and counterarguments. In this integrative approach argumentative writing should also allow a transparent assessment and weighing of different views, acknowledgement of exceptions and reservations to positions, and definition of conditions

under which positions may or may not hold (Nussbaum & Schraw, 2007). In order to skilfully communicate the integration of argument and counterargument in writing, the ability to formulate rhetorical structure, linguistic aptitude, knowledge of topic, and writing conventions are of paramount importance.

In order for the research to better understand argumentative writing and how writers come to deal with such complex and cognitively demanding task, new considerations and concepts are needed.

The level of ability of the writer is very important for understanding the nature of complexity in argumentative writing. The notion of level of ability gives research a penetrating insight into writers' difficulties, learning requirements and potential for improvement. The cognitive models of writing dealt with the complexity of writing process by looking at writing ability (Hayes, 1996; Kellogg, 1994), however they did not address argumentative writing ability in particular. Ability in argumentative writing is evidently characterised by knowledge of writing processes, however genre specific requirements need to be addressed, given the complexity of the task.

Argumentation schema defines one of the two most important aspects in defining ability in argumentative writing. An argumentation schema holds information about setting genre-specific rhetorical goals, generating argument moves of opposing orientation, integrating arguments and counterarguments into positions, structuring coherent argumentative texts, assessing the persuasiveness of content. Central in the conceptual approach taken in this thesis is a range of argumentation schemata that depend on the ability to critically assess and integrate arguments and counterarguments in an overall position. These argumentation schemata, myside bias, pseudo-integration, integration and synthesis, crucially define how well writers integrate arguments and counterarguments in the formulation of a position. This

continuum of argumentation schemata can become a fundamental perspective in examining writers' ability. Text analysis instruments, diagnostic and self-diagnostic tools should be built on the basis of these argumentation schemata.

The other important aspect in argumentative writing ability is the knowledge of strategies applied by writers during the processes of planning, translating and revising in argumentative writing. Research in argumentative text processing (Andriessen & Coirier, 1999) as well as instructional approaches to argumentative writing look into these strategies. However, argumentation schemata and strategies need to be researched together in order to identify in what processes writers engage when they are guided by specific argumentation schemata.

The research of the planning cognition process in argumentative writing involves the interaction between theoretical frameworks of argumentation and writing. In order to comprehend the relationship between these theoretical traditions, two important dimensions play an important role:

- The conceptual link between semantic and rhetorical aspects of argumentative essays based on the framework of argument-counterargument integration encompassing the adversary and conciliatory argumentation strategies;
- The analysis of planning and linearizing processes with the help of argument diagram showed that both processes when mediated by the use of argument diagram contribute to improvement of argumentation structure, both semantic and rhetorical.

More studies looking into the process of argumentative writing are required in order to build a critical mass of evidence on the processes writers engage in order to plan and write an argumentative essay.

The notion of ability in argumentative writing can also provide insight into how novice writers evolve into the next level of development. The knowledge-telling and knowledge-transforming model of writing (Bereiter & Scardamalia, 1987) addressed the aspect of evolution between levels of writing. Writing is seen in this model as, on one hand, an unstructured and spontaneous account of ideas and, on the other, as a reflective process involving constant associations between ideas in view of evolving rhetorical goals. However, the limitation of genre independent approach applies here as well.

We need also to understand how ability in writing evolves within adulthood, including young adults, such as undergraduate students. Research in argumentation has focused on developmental trends of argumentative writing up to adult years (Golder & Coirier, 1994; Knudson, 1994). We know how argumentative skills evolve from mainly addressing supporting argument, in earlier years, to anticipating counterarguments and possibly refuting them, in later years. However, there seems to exist a latent assumption that maturity in argumentative skill is achieved by the age of higher education. Research in critical thinking and reasoning in professional context (Kuhn, 1991; Leitao, 2000) as well as research in academic writing (Carrington et al., 2011; Wolfe et al., 2009) has shown that adults' skill in argumentation and argumentative writing need and could evolve later in life.

Different levels of abilities have different evolution trajectories. Lower ability learners require different type of support, over a longer time and within specific environments than higher ability level. The trajectories need to be investigated and discussed and articulated. Enabling factors, such as dialectic thinking, and inhibiting factors, such as resistance to think from different perspectives need to be identified. Strategies for enhancing enabling factors and removing inhibiting ones should be introduced.

The quality and intensity of scaffolding a writer requires for increasing her ability in argumentative writing should also become the focus of research. The appropriateness of procedural facilitation depends on the level of ability. The success of the scaffolding aid is doomed if it is not aligned with the appropriate level of argumentative writing ability. Argument diagramming brings together representations of argumentation schemata with procedural facilitation for planning, translating and revising. Argument diagramming also enhances the portfolio of writing strategies of writers. Writers who reflectively engage in argument diagramming may activate known argumentation schemata, adapt existing ones, or experiment with new ones.

Externalising argument structure in the form of argument diagram allows the writers to interact with the process of argumentation formulation and with the product. Argument diagramming allows interacting with processes such as deliberating over the position, for example, engaging in examining how adding a new textbox affects the balance of argumentation. On the other hand, the argument diagram as a product generates new planning goals such as to invent more counterarguments in order to present a less biased debate, or evaluate the relevance of textboxes to position. Interacting with argument diagramming activates latent argumentation schemata or may enhance existing ones. Some of the low and middle level participants who contested that introducing counterarguments may weaken their position changed their perception.

Research in argumentative writing should ideally have a comprehensive character in order to evaluate the plethora of perspectives, concepts and interventions. The evaluation and assessment of argumentative text is polyvalent and multi-layered. The overall holistic assessment gives a valuable but cumulative estimation of the writers' ability. In order to diagnose the impact of scaffolding and instructional interventions research needs fine grain

instruments and methods that are able to isolate factors, aspects, and perspectives and measure them independently. Moreover evaluating argumentative writing on the basis of the produced text only is limiting our understanding of the ability of writer. The processes, strategies, schemata, affective components and writing environments that contribute to the production of text are rarely examined. Argumentative writing is seen in this context as a multimodal activity involving interacting with planning artefacts, internal argumentation schemata, writing tools, affective and motivational dispositions of the writer. In the context of multimodal analysis of writing, research into argumentative writing faces the challenge of analysing the outcome, the intermediate plans and drafts, the process, and the writers' perception in tandem (Jewitt & Kress, 2003).

This study has experienced the limitations of current methodologies capturing data on the process of writing (in studies 1a and 1b). Non-user friendly or intrusive methods of data capturing inevitably limit the amount of evidence that can be captured. New methods need to be developed to ensure that data are collected in an efficient and effective way.

7.5 Implications for teaching and education

Argumentative writing can play a very important role in formal and higher education but also later in continuous professional development.

Starting with the level of formal education, schools can benefit from introducing argument diagramming in the curriculum to support the teaching of essay writing. Although some effort is done to this direction, mainly in exceptional schools that are at the forefront of educational research, argument diagramming could expand to mainstream schools as well. Implementing, however, such educational agenda requires textbooks, guidelines, and training seminars to support teachers in using argument diagramming in the classroom. Online open source databases can be organized to include lesson plans and learning scenarios. Currently we find

relevant accompanying tools such as the Rationale software but these are not adapted to national curricula and course-specific requirements.

At university level, argument diagramming could be introduced in writing centers to help students who are entering higher education, to understand the requirements of academic writing. Students are very often confused as to how they are expected to express their voice in writing. This problem is more prominent amongst students who come from different educational systems and cultures. However, in order to pursue this line of work, writing centers should be able to diagnose the level of argumentative writing ability and use argument diagramming to train students.

The development of massive open online courses (MOOCS) can also benefit by courses on argumentative writing and the provision of tools to support argumentative writing like argument diagramming. The success of argument diagram publications, such as the archetypical “can computers think” (Horn, 2003), could have massive impact. At the same time the building of such diagram publications could be the object of a kind of Wikipedia. The academic community could be the leading force behind such a project.

Professionals like lawyers, doctors, managers and entrepreneurs, and public servants also need support in writing persuasive and coherently structured reports, addressing all sides of an argument. This is especially the case when part of their job is to publish recommendations, make cases for funding, and file compensation claims and complaints. While the generic argumentation concepts may be useful to a certain extent, professionals would need access to context-specific argumentation concepts, nuances, conventions, and rhetorical strategies.

Implications and benefits are also seen in the area of computer-assisted learning and writing.

Argument diagramming could be seen as an indispensable part of virtual learning environments (VLE), where teachers of academic writing and students could virtually meet in order to discuss and exchange feedback on issues of argument structure and content with reference to specific papers and assignments. Some efforts and applications are already seen with web-based argument diagramming applications but these need to be implemented so that they are ready to be 'plugged in' existing learning platforms. Such applications could be enhanced with more intelligent components. Advances in natural language processing and technology, underlying the latest applications in automated essay scoring, could be combined with argument diagramming. They could then provide a diagnostic tool for identifying lack of argumentative coherence and relevance of topic through an argument diagramming visualization interface. User modeling that is informed by user levels in argumentative writing and knowledge of argumentation schemata could also inform systems that provide more personalized scaffolding to writers.

Computer-supported argument diagramming should also extend the range of notational systems to ensure that they accommodate the development of more sophisticated positions such as contingent positions. Computer-supported argumentation systems should include more than one notations in one platform, e.g. matrices, Vee diagrams, argument trees etc. to allow for diversification of representations according to user needs and domain requirements. Tools for allowing users to create their own notation should also be provided, either as a separate view or as a layer for annotating established notations.

7.6 Further research

Studies 1a and 1b, and Study 2 investigated the impact of using argument diagramming over a short period of time although with application of sophisticated measures. Taking this research perspective further should aim to a more comprehensive approach with regards to

academic disciplines and time frame. In particular, further research in this direction would involve extending the duration of the argument diagramming support and integrating it as part of an instructional intervention that is explored in the context of a longitudinal study. Assessment data should be collected many times to trace milestones in the writers' progress. The types of tasks should be diversified to include more complex writing projects. Quantitative instruments for measuring argumentative writing qualify should be also designed and validated.

Another interesting research direction would be to conduct comparative writing studies with discourse communities that engage in problem solving and argumentation, such as medical reasoning, legal reasoning and business management. It would be interesting to investigate the needs of these professionals regarding writing and argumentation and whether or what type of argument diagramming would support them.

Research frameworks and instruments of metacognitive awareness and argumentation schemata could be explored further with more writers, of a wider range of writing expertise, culture, and age. It would be very interesting to focus on writers' perception of argumentation that comes from different cultures, where argumentation schemata may be conceived in totally different ways. Furthermore research may take a step further and investigate how the perception of argumentation schemata of writers, who change country for educational or professional purposes, adjusts.

Diagrammatic notations, that include but also go beyond the known diagram trees and matrices, are needed to investigate ways for better representing conciliatory strategies such as weighing and synthesis contingent.

From a psychological and social psychology perspective the role of argument moves in everyday life can also be explored. RST analysis and frameworks of argumentation schemata

and argumentation structure awareness can be used to explore a range of phenomena. For example, how people formulate and express a position; how they behave when they participate in heated debate; how they perceive conflict and compromise in relation to others; how they respond to criticism; how they change stance, and how they engage in a dialogue with themselves. It would be interesting to investigate people personalities and relating behaviour through the prism of argumentation schemata.

Taking a more technology oriented approach, research on digital paper products or tablet design could experiment with argument diagramming applications. There are many possibilities in combining the more formal argument diagram-like notations with informal hand annotation on the same electronic platform. Argument diagramming can also be enhanced with language processing technology to support the identification of incoherent connections or irrelevant content.

APPENDICES

Appendix I Definition of components and relation of Argument Grammar

The definitions below are based on based on (Crammond 1997, p.51-60) and (Crammond 1998, p.257-264)

Subclaim: It functions as a secondary or minor claim. It is related to a main claim and may express in relation to the claim qualification, reservation, or a specific instance of the general case stated in the claim.

Example:

I think animal training is all right as long as the animal doesn't disagree (Claim). To teach a dog to stop biting, barking, sit roll over etc…is okay (Subclaim).

Constraint: It marks a presupposition. It serves to 'constrain the applicability or validity of the main claim by specifying the particular circumstances under which the claim would apply' (Crammond, 1997, p.56).

Example:

It's fine to train animals if (constraint) there is no cruelty, undue pain or restriction involved.

Reservation: This structure is similar to constraint in that it limits the universal applicability of the claim. However, while Constraints represent substructures that necessarily must be present for the claim to remain valid and applicable, Reservations substructures represent circumstances that necessarily must be absent. They represent the arguer's acknowledgement and acceptance of circumstances that would defeat a claim.

Training guide dogs to guide people was a very good idea, for us.

(Reservation) But think of how the animals feel.

Countered Rebuttal: A countered rebuttal consists of a potential rebuttal and a response to rebuttal.

Potential rebuttal: This is information that challenges and could potentially defeat a claim and Response to rebuttal is the arguer's attempt to counter the force of the potential rebuttal

Unlike the Reservation structure the circumstances that may defeat a claim are countered in the case of countered rebuttal. "In effect, by including a Countered Rebuttal, the arguer continues to present the claim as being acceptable and applicable even in light of circumstances that might refute it or undermine its force" (Crammond, 1998.p.262).

Example:

Performing tricks is nice too. (CLAIM) All those people who say itsn't nice to teach animals tricks, (Potential Rebuttal) you find them one day or the other watching the circus or an animal parade and enjoying it! (Response to rebuttal)

Alternative solution:

An Alternative solution is a possible solution or answer to the problem statement or questions considered in an argumentative text. It is differentiated from the claim advanced by the arguer. Lexical (e.g. *other* may say, *you* may think) or semantically analysis may help in identifying this substructure

Example:

Some wholly reject such training (Alternative solution 1) others rejects all objections (Alternative solution 2) I would propose a middle way with various criteria (Claim).

Appendix II Argument Grammar Production Rules

ARGUMENT ::= CLAIM.REL JUSTIFICATION.REL *{OPPOSITION.REL}*

CLAIM.REL ::= CLAIM
JUSTIFICATION.REL ::= JUSTIFICATION
OPPOSITION.REL ::= REBUTAL.REL |ALTERNATIVE SOLUTION.REL

CLAIM := ASSERTION.REL
CONTENTIOUS.REL*{QUALIFICATION.REL}*{SUBLAIM.REL}*
ASSERTION.REL::= COMPONENT
CONTENTIOUS.REL::= EVALUATION | INTERNAL.STATE | MOD.QUAL
|PROBLEM.STATEMENT
QUALIFICATION.REL:: MODAL.REL |CONSTRAINT.REL
CONSTRAINT.REL::= ATRIBUTE| OBJECT |COMPONENT
SUBCLAIM.REL = CLAIM| ARGUMENT

JUSTIFICATION :: DATA.REL {WARRANT.REL} {D.BACKING.REL}*
{W.BACKING.REL}*
DATA.REL::= COMPONENT | ARGUMENT | CLAIM
WARRANT.REL:=COMPONENT |ARGUMENT
D.BACKING.REL ::= OBJECT| COMPONENT
W.BACKING.REL ::= OBJECT| COMPONENT

REBUTAL.REL::= RESERVATION.REL |COUNTERED.REBUTAL.REL
RESERVATION.REL::= COMPONENT | CLAIM| ARGUMENT
COUNTERED.REBUTTAL.REL::= COUNTERED.REBUTTAL
COUNTERED.REBUTTAL ::= POTENTIAL.REBUTTAL.REL
RESPONSE.TO.REBUTTAL.REL
POTENTIAL.REBUTTAL.REL:= COMPONENT | CLAIM |ARGUMENT
RESPONSE.TO.REBUTTAL.REL::= COMPONENT | CLAIM |ARGUMENT

ALTERNATIVE.SOLUTION.REL ::= CLAIM |ARGUMENT

Appendix III Argument structure components of analysis scheme

<table>
<tr><td>Argument structure components in Crammond (1998)</td><td>Argument structure links in Crammond (1998)</td><td colspan="2">Argument structure links as applied in analysis</td></tr>
<tr><td rowspan="4">Argument,
Claim ,
subclaim,
Constraint,
Modal,
Data,
D. backing,
Warrant,
W. backing,
Countered Rebuttal ,
POTENTIAL REBUTTAL,
RESPONSE TO REBUTTAL,
RESERVATION,
ALTER.SOLUTION</td><td rowspan="4">claim.rel
subclaim.rel
constraint.rel
modal.rel
data.rel
d.backing.rel
warrant.rel
w.backing.rel
opposition.rel
potentialRebuttal.rel
resposneToRebuttal.rel
reservation.rel
alternativeSolution.rel</td><td>Crammond’ model relations</td><td>Simplified to</td></tr>
<tr><td>data-claim,
warrant-claim,
d.backing-data, w.backing – warrant,
pot.rebuttal – countered rebuttal, response to rebuttal – countered rebuttal
cliam- subclaim relation</td><td>Supporting relation (sup.rel)</td></tr>
<tr><td>opposition.rel for modal.rel relations:
argument -reservation,
argument - countered rebuttal,
argument-alternative solution</td><td>Counter argumentation relation (counter.rel)</td></tr>
<tr><td>Constraint
Modal (both remain)
is a relation</td><td>constraint.rel
modal.rel
is a.</td></tr>
</table>

Appendix IV Semi structured interview questions (baseline essay)

[general, profile, warming up conversation]
1.What did you think about the topic? (easy, difficult, boring, etc.)
2.How do you feel about writing in general? (enjoy, struggle, hate etc.)
3.In particular how do you find argumentative writing (easy, demanding, confusing)?
4.Do you have to write argumentative essays now as university assignments?
5.What are you main weaknesses and strengths when you write an argumentative essay?
[specific - plan]
6.Is this [referring to baseline essay] how you normally plan an argumentative essay? *a. How do you go about writing essays? (plan on paper, write on computer).* *b. What is your usual habits/procedure?* c. *Have you used this type of plan before?*
7.Please take me through what you did in the plan: *a. Just read it first…* *b. Explain what lines, bullets, arrows etc. mean…* c. *What was the purpose of this plan (brainstorm? argument orientation? Order of paragraphs, into-main-conclusion? other?)*
8.While you were doing the plan did you consider the suggested points? *a. Where the points easy to understand?* b. *Of the given point which one you find more difficult to implement?*
[specific essay]
9.Look at the essay now…(…so at some point you decided it is time to start writing up….) How did the plan helped you to start and continue writing up? *a. What made you decide that it was time to start writing up?* *b. Did the plan help you to decide what to write first?* *c. While writing the essay did you look back to your plan?* d. *If they used more than one types of plans, e.g. semantic and rhetoric, on which they relied more during writing*
10. Was all the content of the plan covered in the essay? *a. Do you think there are points you did not include? Why?* *b. Did you follow the order /structure of the plan?* c. *If they had a draft between the plan and the essay what was its role?*
11. While you were writing the essay did you consider the suggested points?

a.	Of the given point which ones you find more difficult to implement?
	[specific -revising]
12.	In the end you revised… *a. What did you do during your revision? Did you move any paragraphs? Did you stick to sentence-level revision?*
	[general]
13.	Are you happy with the essay you wrote? a. *What was difficult about it, what was stressing?*
14.	The planning and the writing phase in particular. Which one do you find more difficult?
15.	Is there a common comment that you receive to your written work?

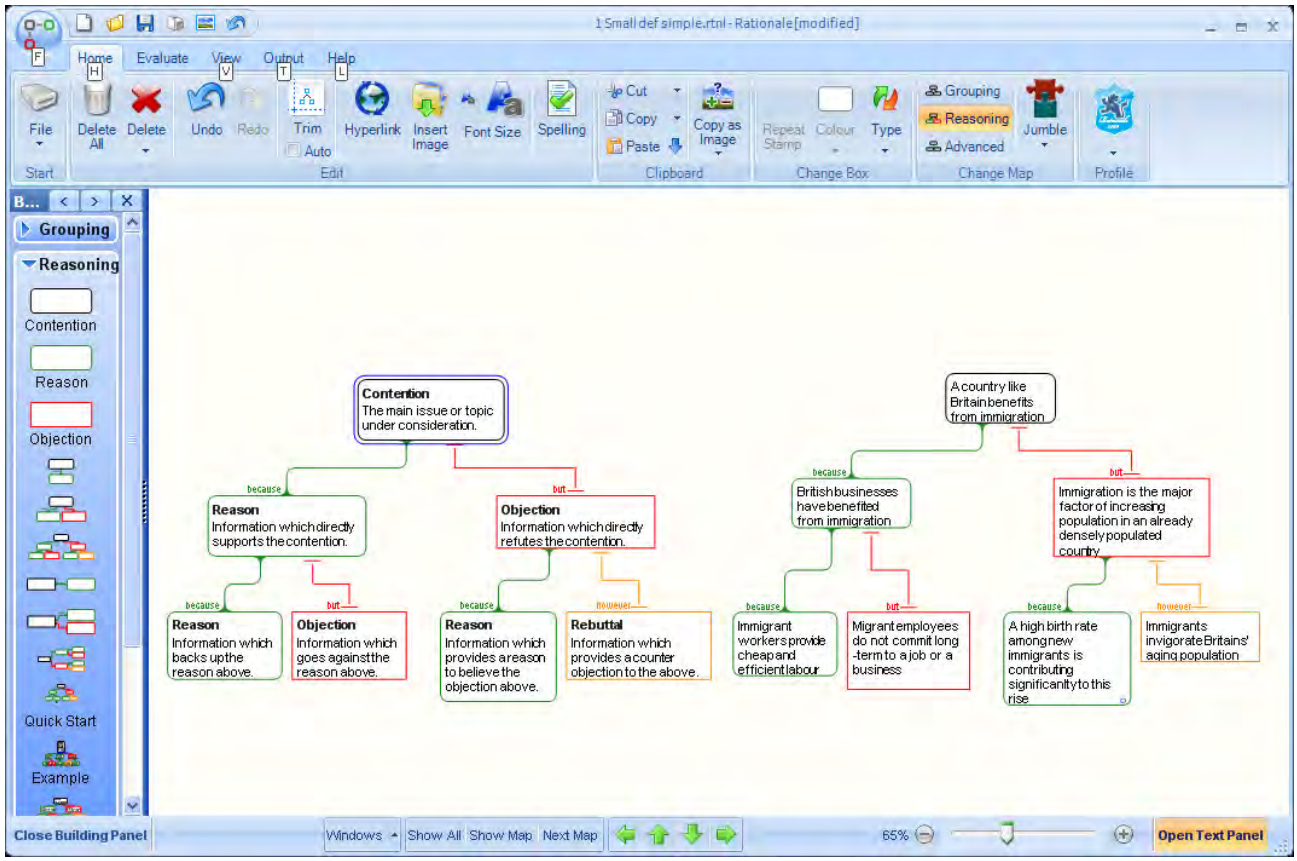
Appendix V Semi structured interview questions (posttest essay)

[general, profile, warming up conversation]
1. What did you think about the topic this time? (easy, difficult, boring, etc.)
2. Compare the essay you wrote today and the previous day. What do you think?
3. What are your first impressions from using the method of argument mapping? What is the main advantage and disadvantage of this approach?
4. Was it easier this time to write the essay? More demanding, more confusing?
[specific - plan]
5. Please take me through what you did in the plan: a. *Read it together..(for reference when transcribing later)*
6. Did the diagram method help you to plan your essay? If yes in what way?
7. While you were doing the plan did you consider the suggested points? a. *Of the given points, which one you find more difficult to implement?*
[specific essay]
8. Look at the essay now…(…so at some point you decided it is time to start writing up.…) How did the plan helped you to start and continue writing up? a. *What made you decide that it was time to start writing up?* *b. Did the plan help you to decide what to write first?* c. *Did you reflect on how to order the content of your essay*
9. How did the plan help you to continue writing the essay? a. *While writing the essay did you look back to your plan?* b. *Did you consider revising/changing your plan while you were writing your essay?*
10. How did the outline help you to write the essay? (PC QUESTION only)
11. Was all the content of the plan covered in the essay? a. Do you think there are points you did not include? Why? b. Did you follow the order /structure of the plan? c. If they had a draft between the plan and the essay what was its role?
12. While you were writing the essay did you consider the suggested points? a. Of the given point which ones you find more difficult to implement?
[specific -revising]

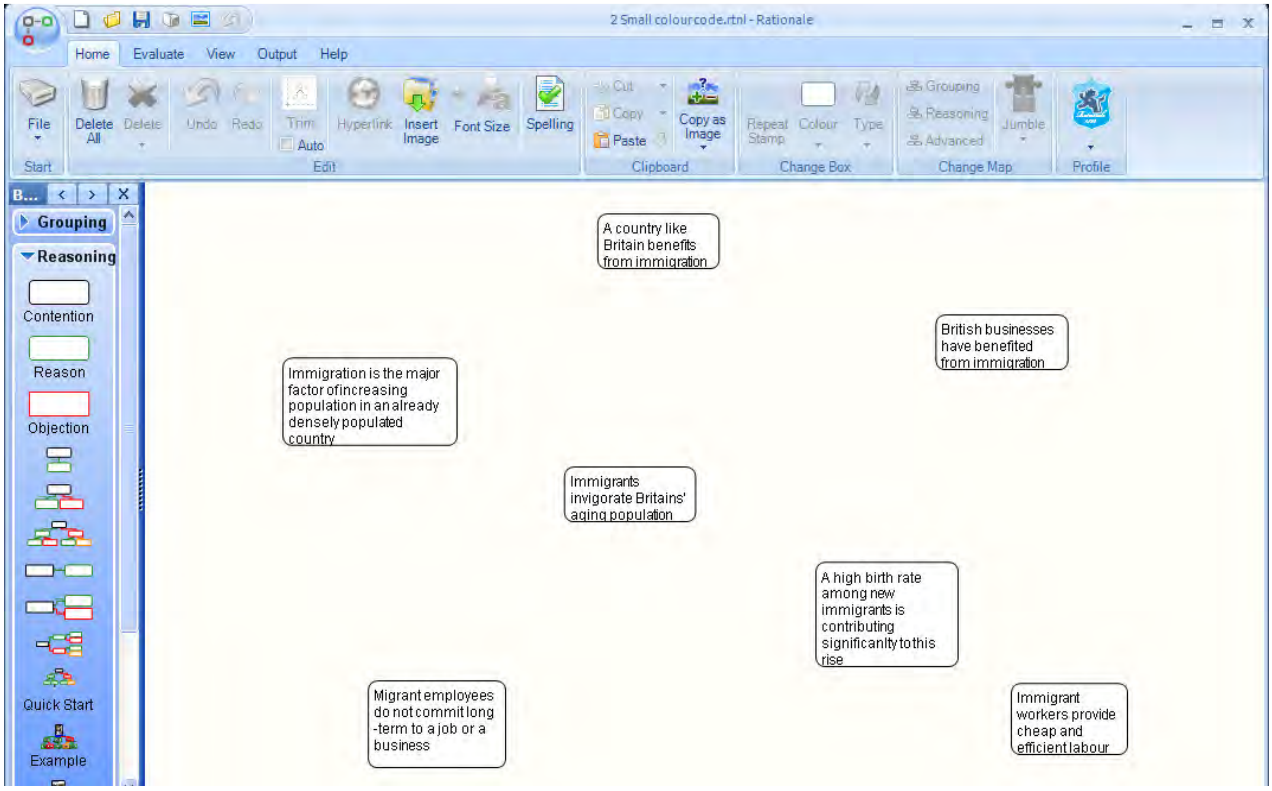
13. In the end you revised… a. What did you do during your revision? Did you move any paragraphs? Did you stick to sentence-level revision?
[general]
14. Are you happy with the essay you wrote?
15. How did you find the method overall a. Demanding? Uncomfortable to use? Unnatural? b. What was difficult about it, what was stressing?
16. Would you use it again? If yes in what context? Would you use it if you were under pressure?
17. Compare the process of essay writing today and the previous day. What do you think? Has something changed in the way you deal with argumentative writing?
18. Did you learn anything, if at all, from using this method?
19. The planning and the writing phase in particular. Which one do you find more difficult now?
20. The other day you mentioned you had a particular difficulty with argumentative writing. Do you think the method has helped to deal with this weakness?

Appendix VI Steps during training in computer-based method

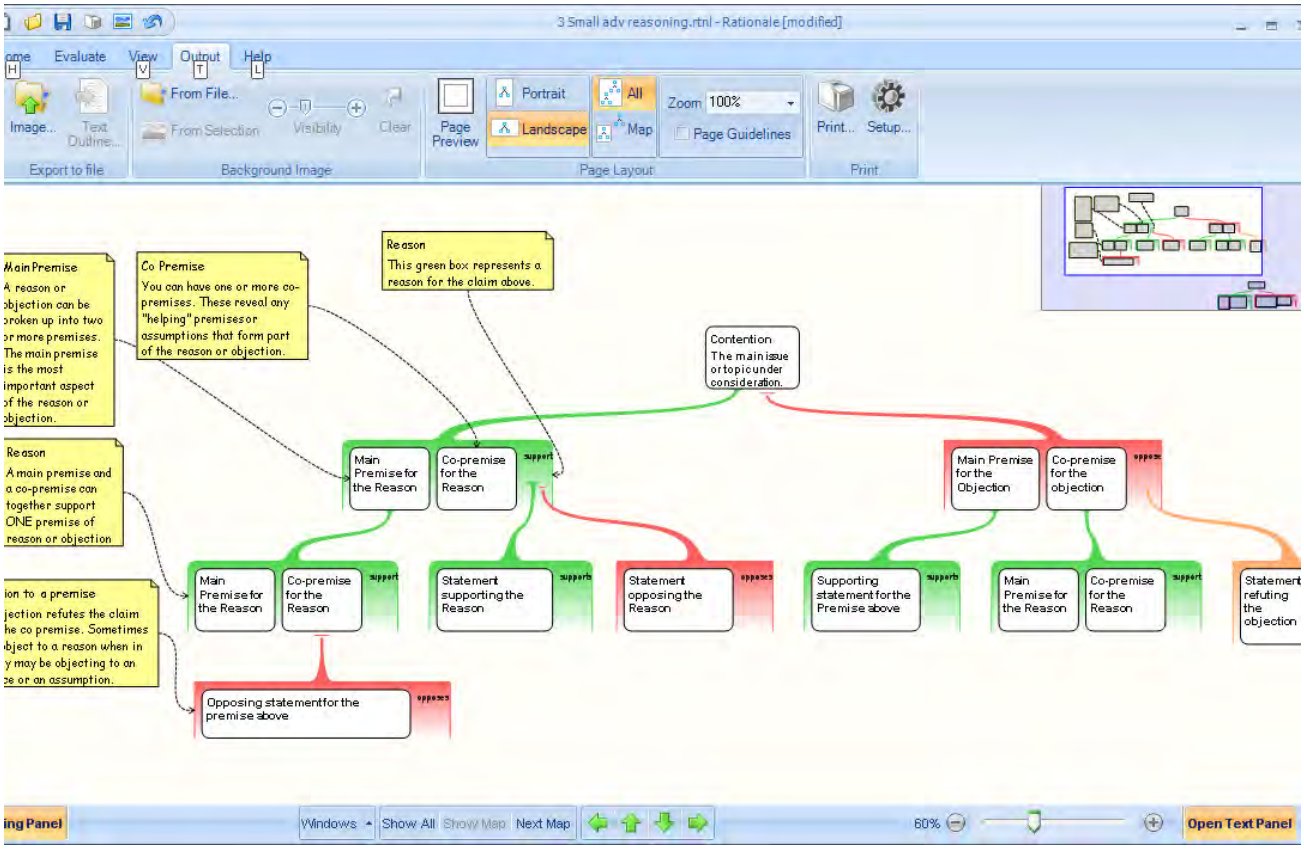
Step 1: Definition of reasoning map and example diagram

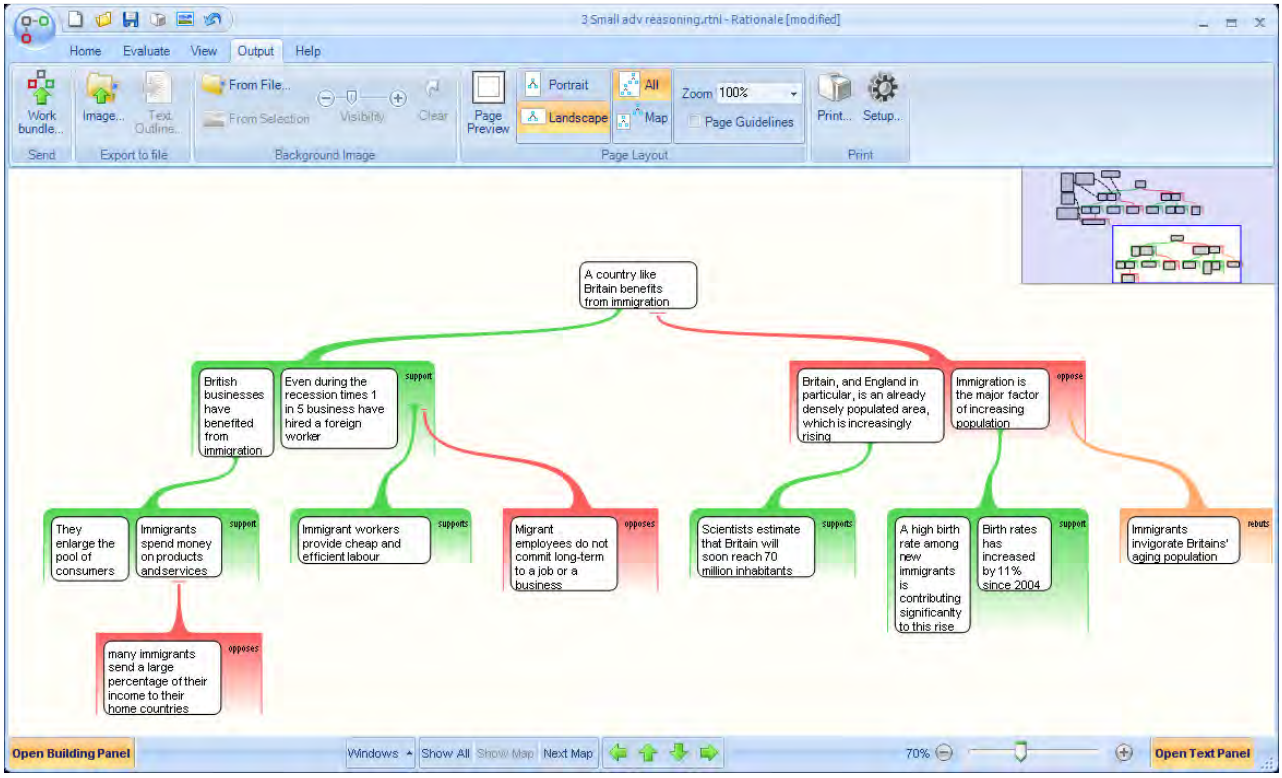


Step 2: Re-assemble example diagram with reasons and objections

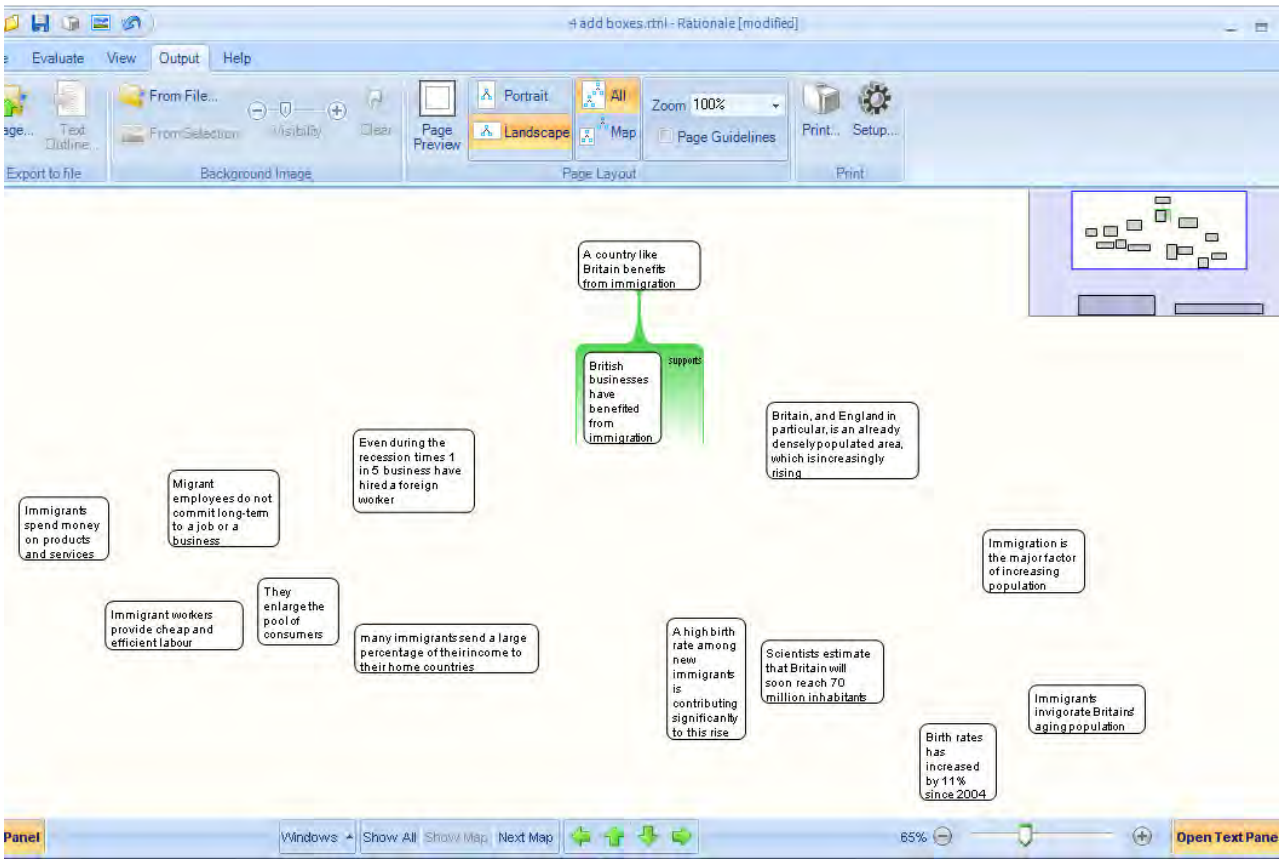


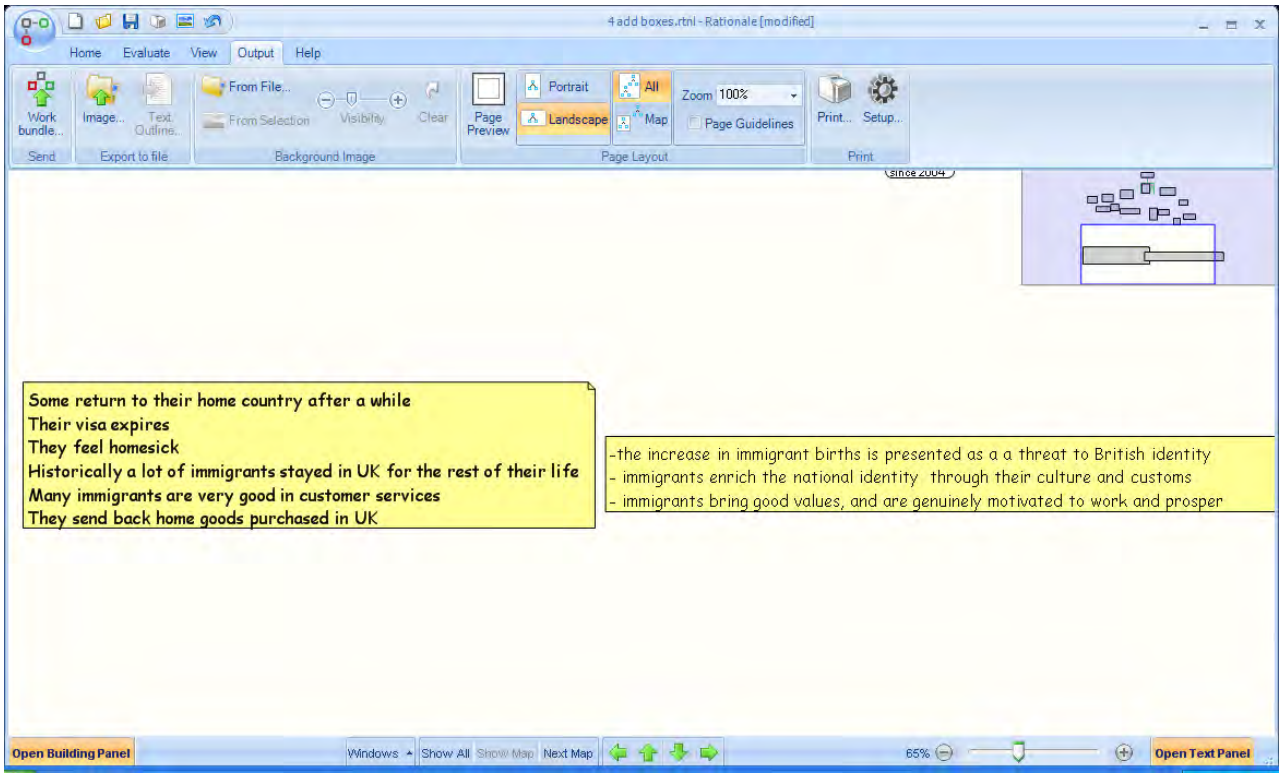
Step 3: Definition of advanced reasoning map and example





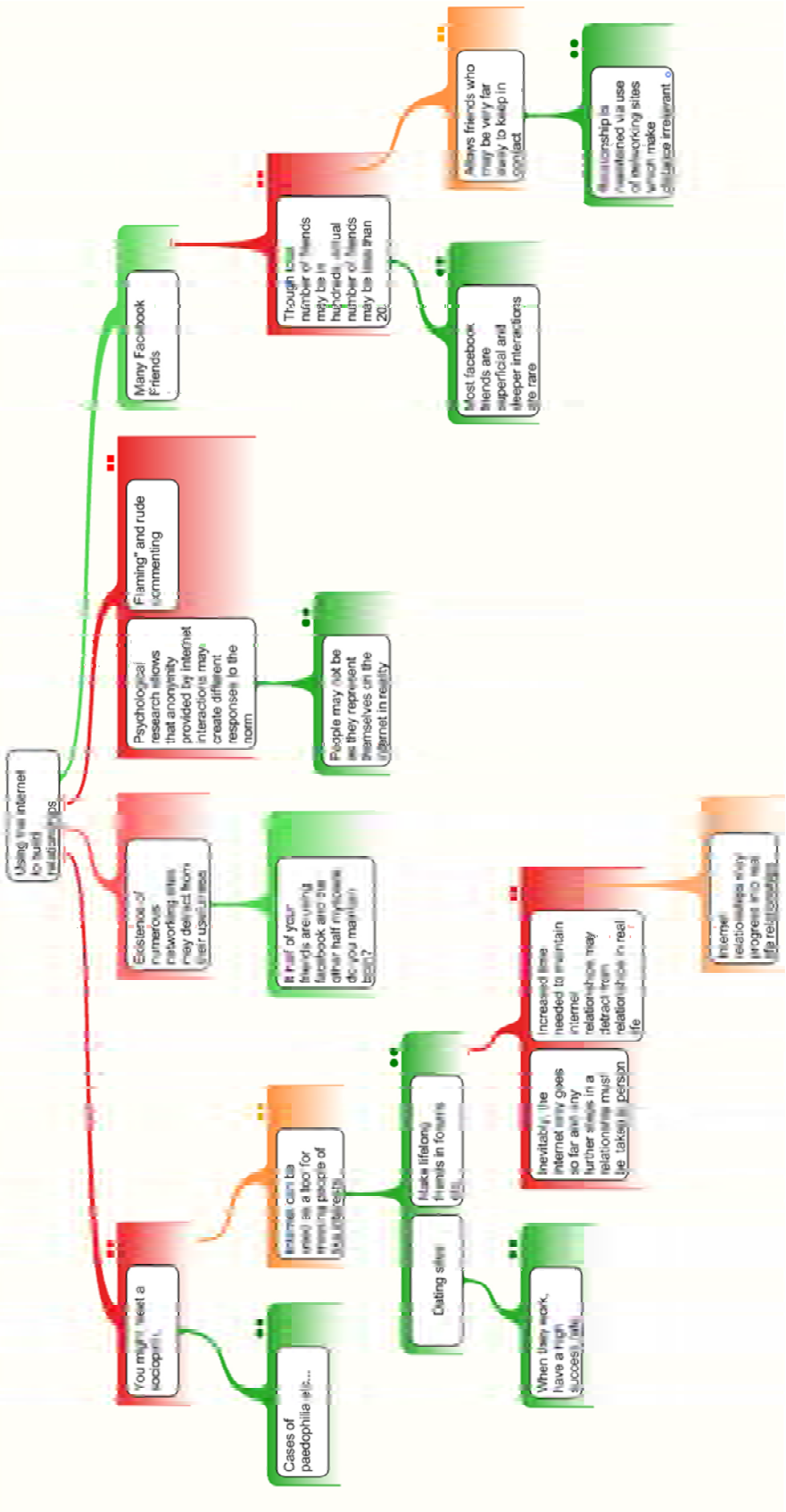
Step 4 Re-assemble advanced reasoning example diagram and add sentences below to develop the diagram



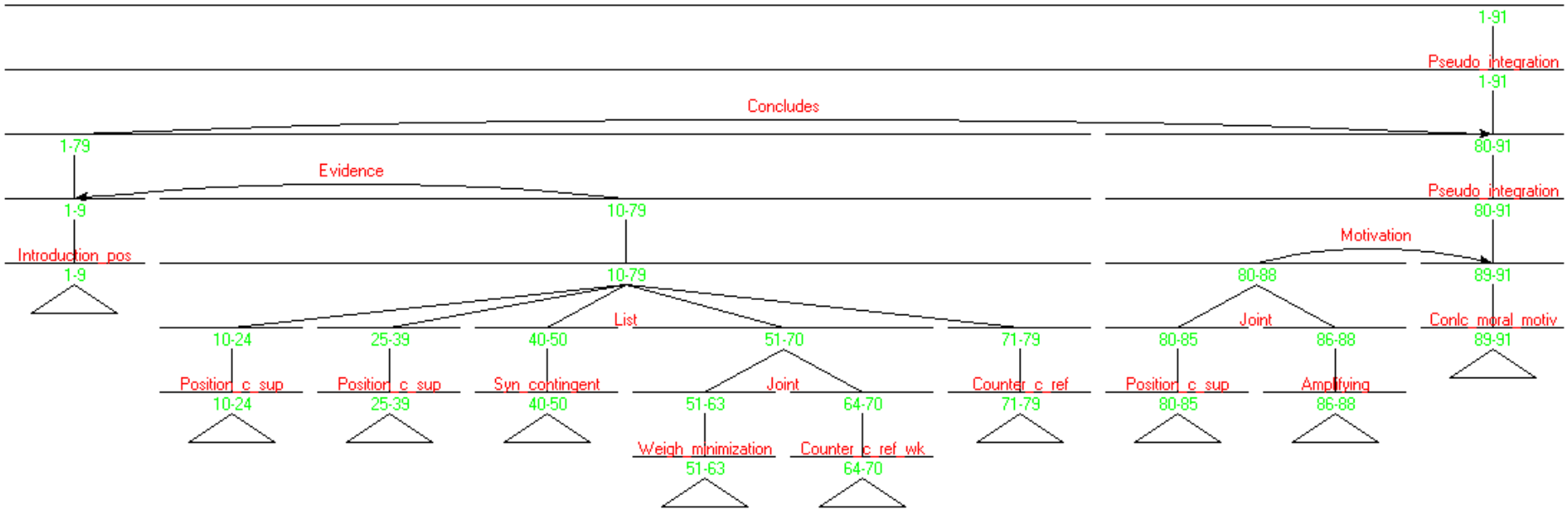


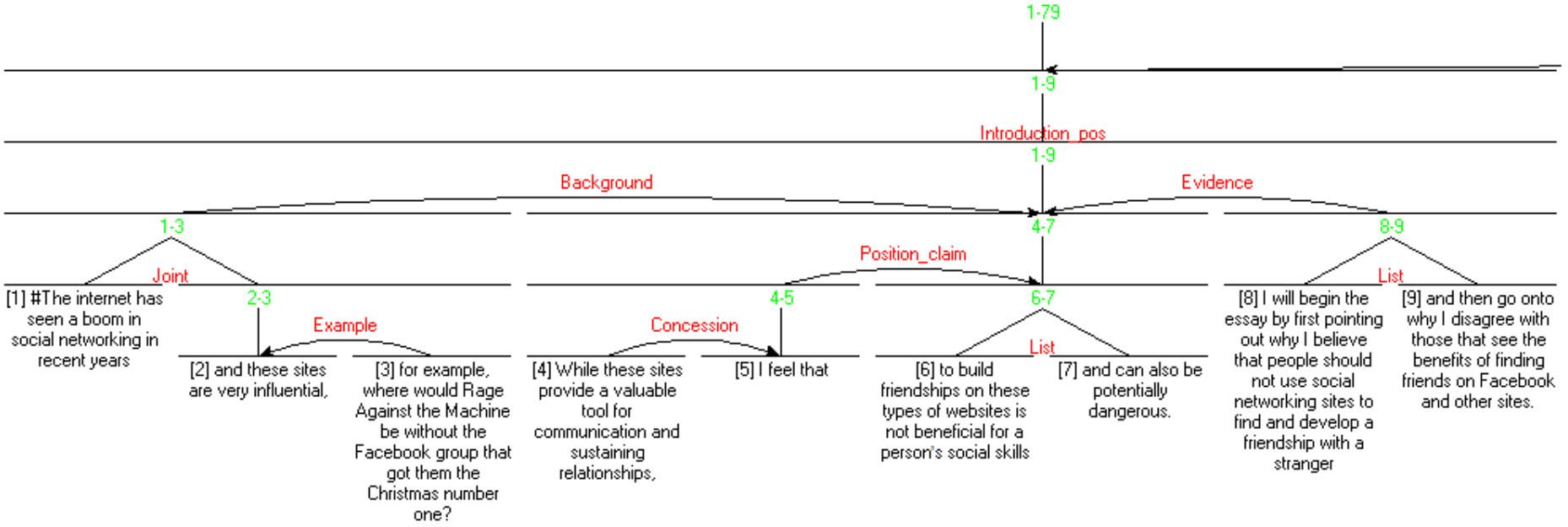
Step 5 Expand diagram further

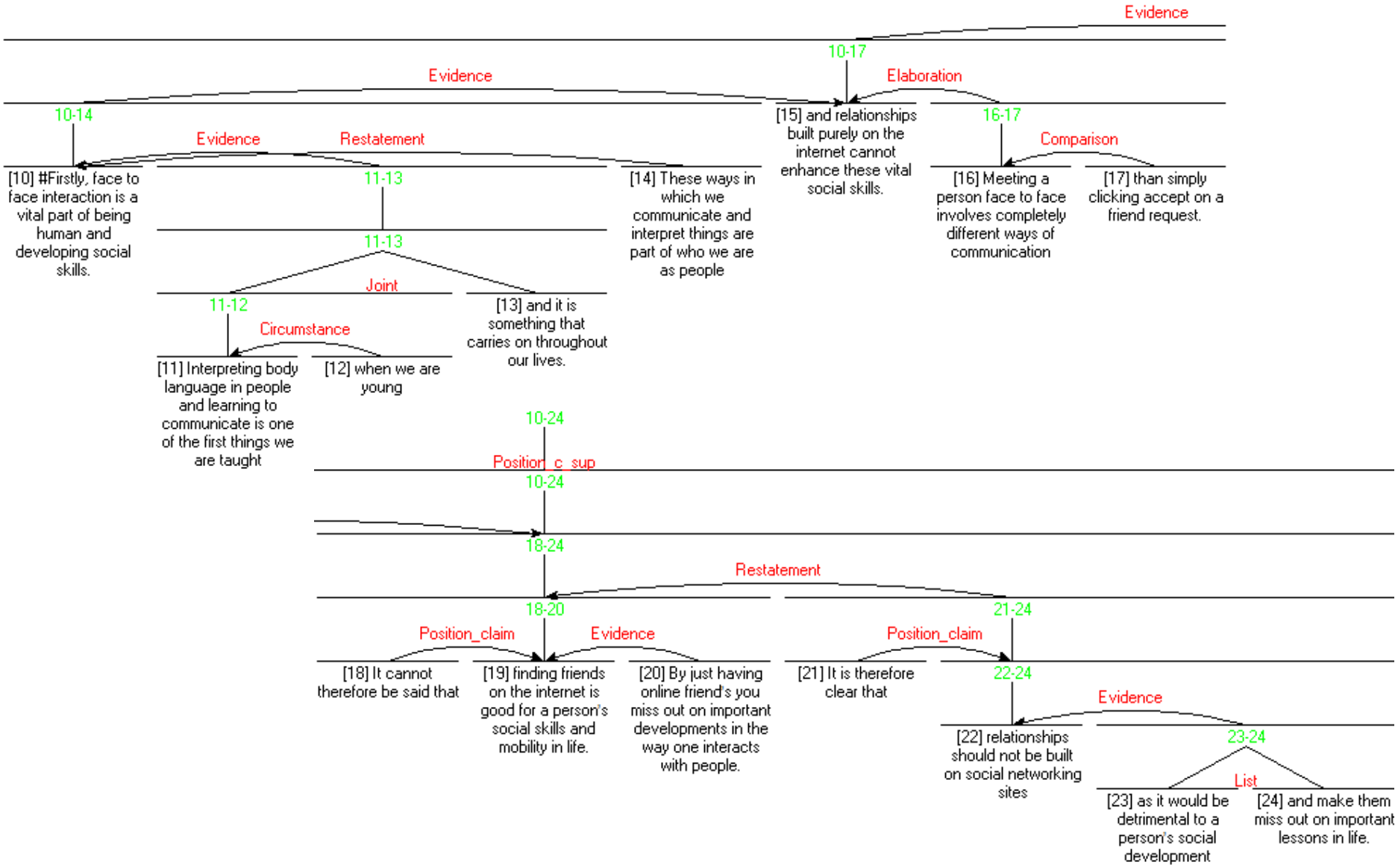
Step 6 Produce your own plan on the same topic you wrote your essay

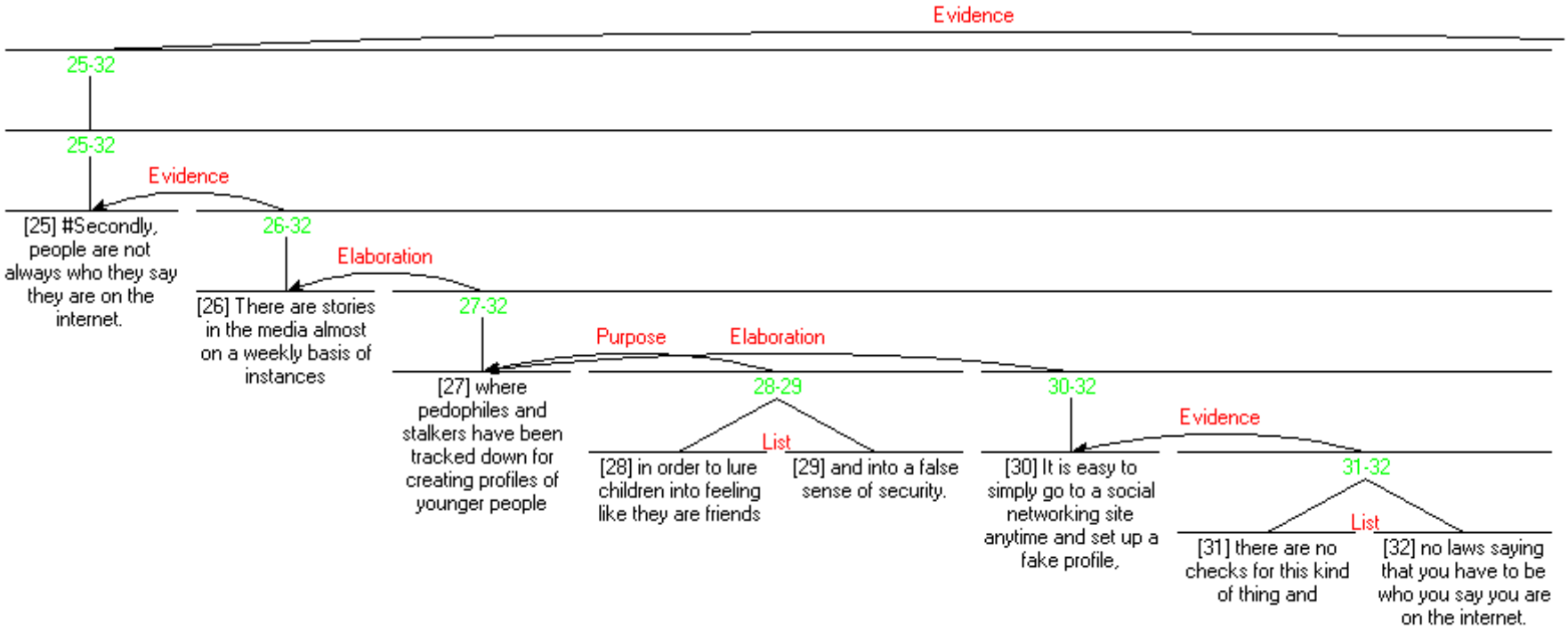


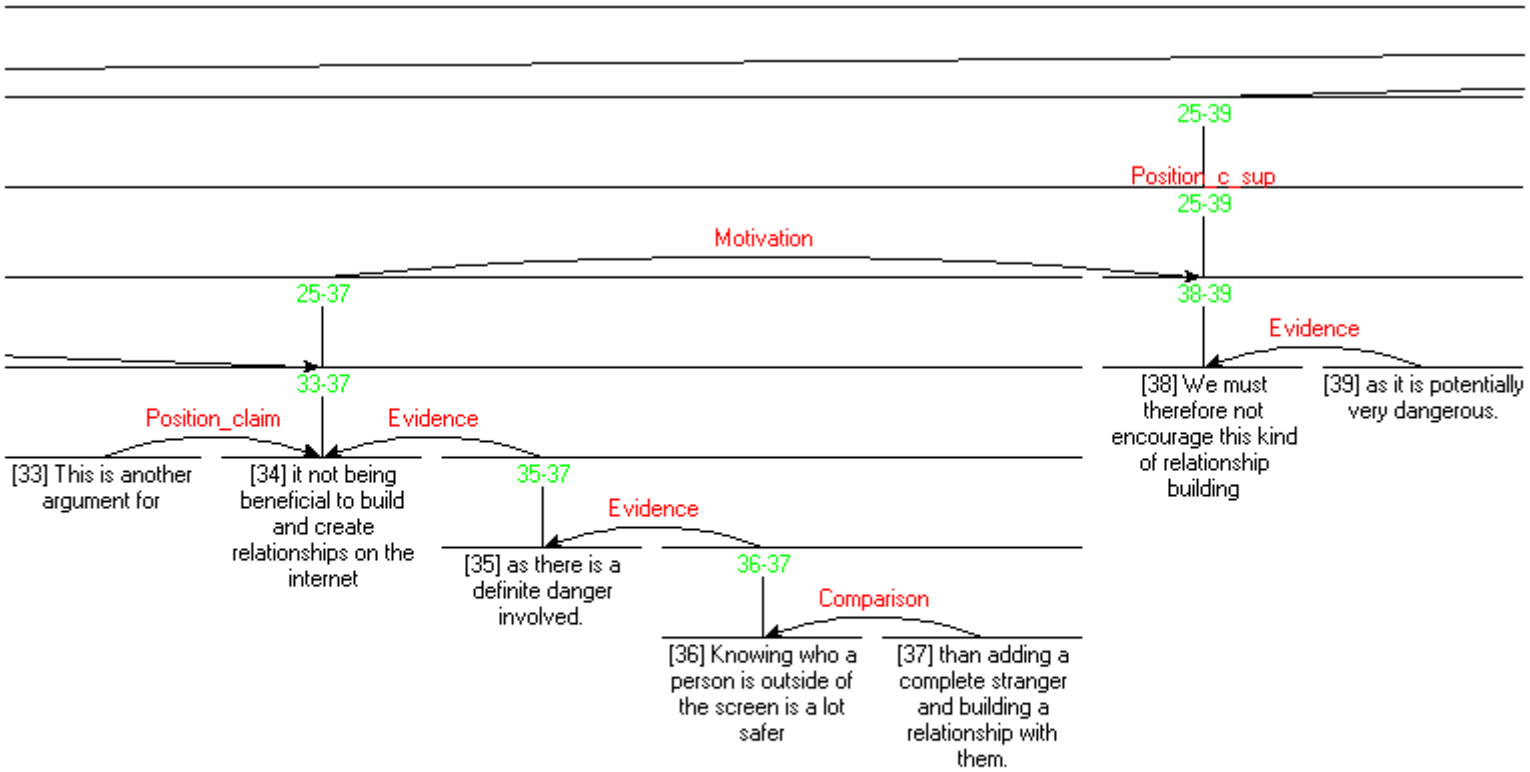
Appendix VII RST examples

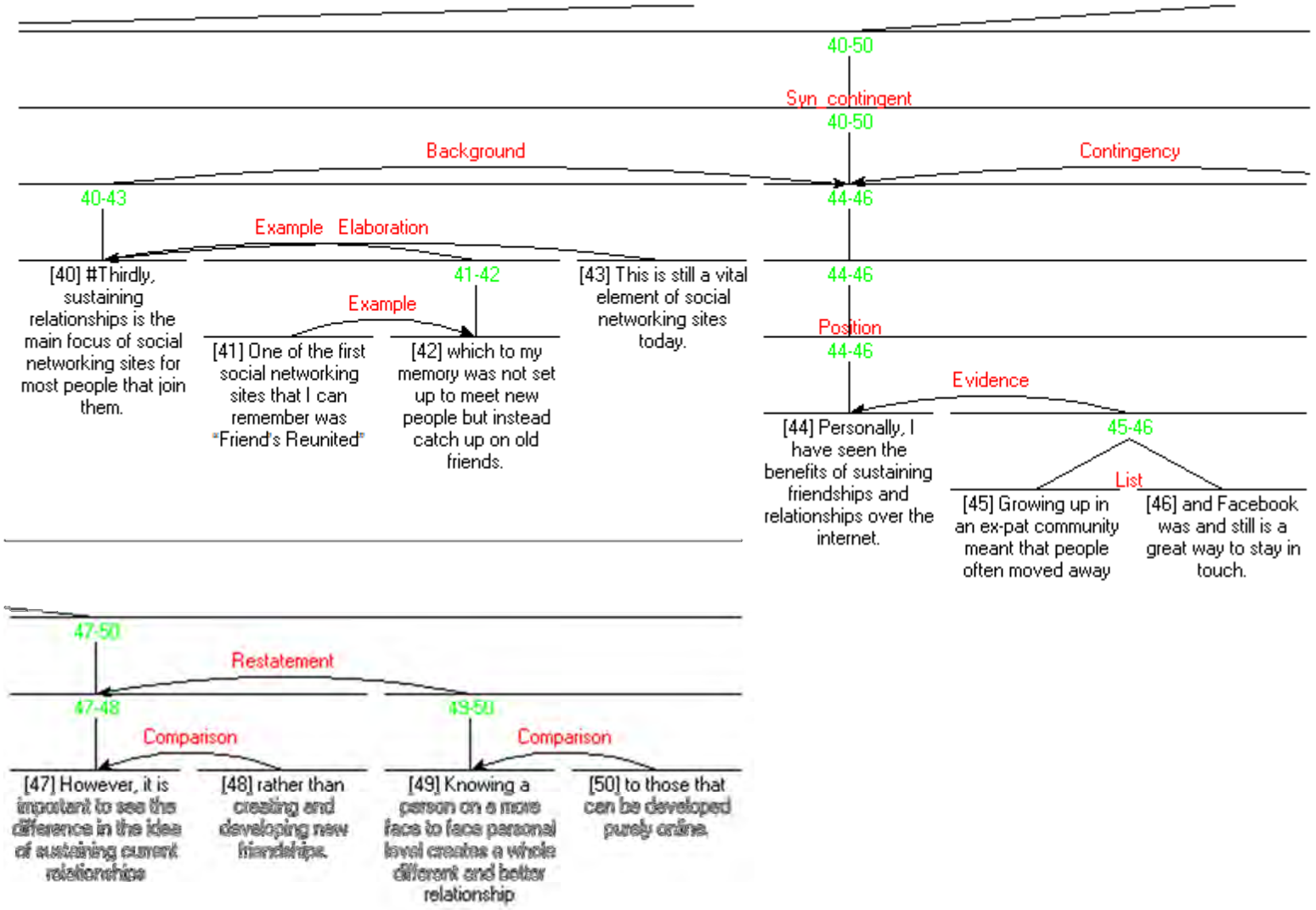


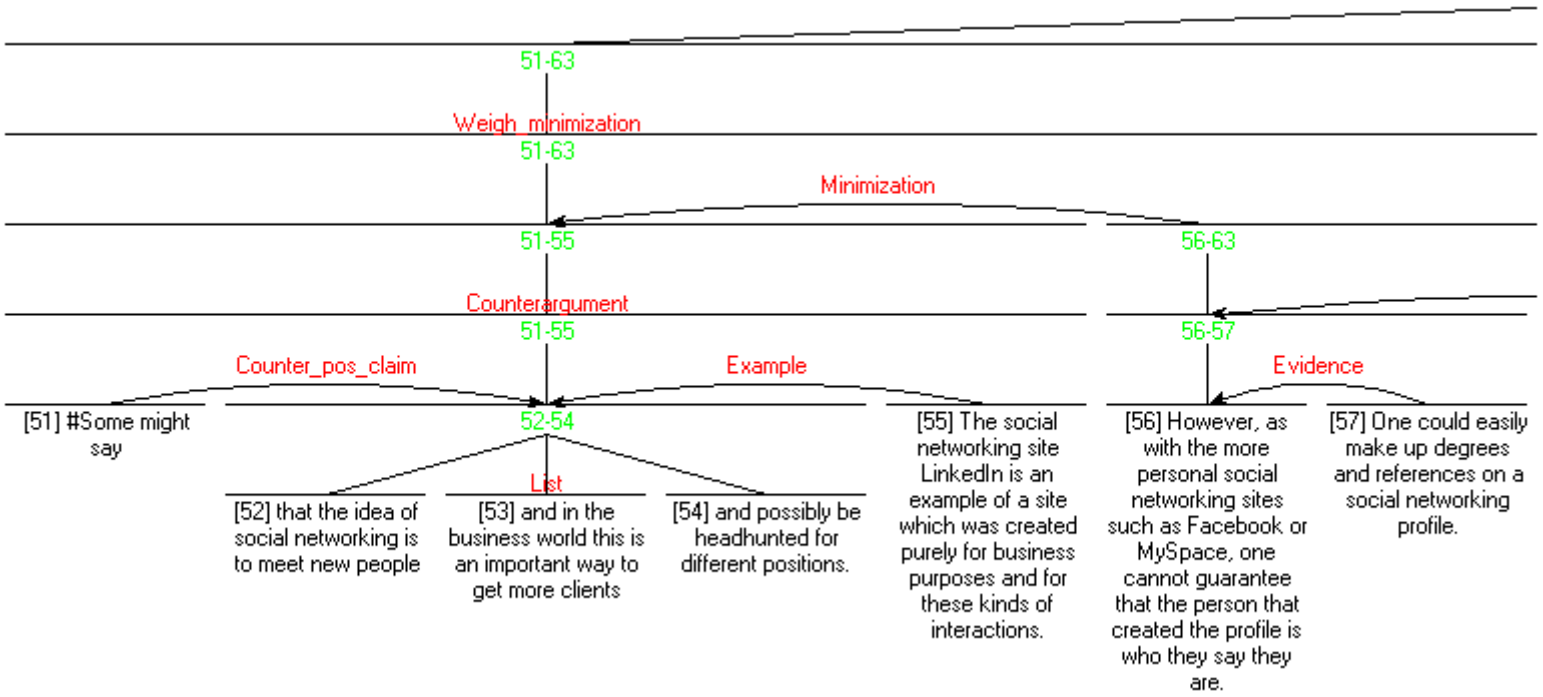

1-79
1-9
Introduction_pos
1-9
Background
Evidence
1-3
4-7
8-9
Joint
Position_claim
List
[1] #The internet has seen a boom in social networking in recent years
2-3
4-5
6-7
Example
Concession
List
[2] and these sites are very influential,
[3] for example, where would Rage Against the Machine be without the Facebook group that got them the Christmas number one?
[4] While these sites provide a valuable tool for communication and sustaining relationships,
[5] I feel that
[6] to build friendships on these types of websites is not beneficial for a person's social skills
[7] and can also be potentially dangerous.
[8] I will begin the essay by first pointing out why I believe that people should not use social networking sites to find and develop a friendship with a stranger
[9] and then go onto why I disagree with those that see the benefits of finding friends on Facebook and other sites.

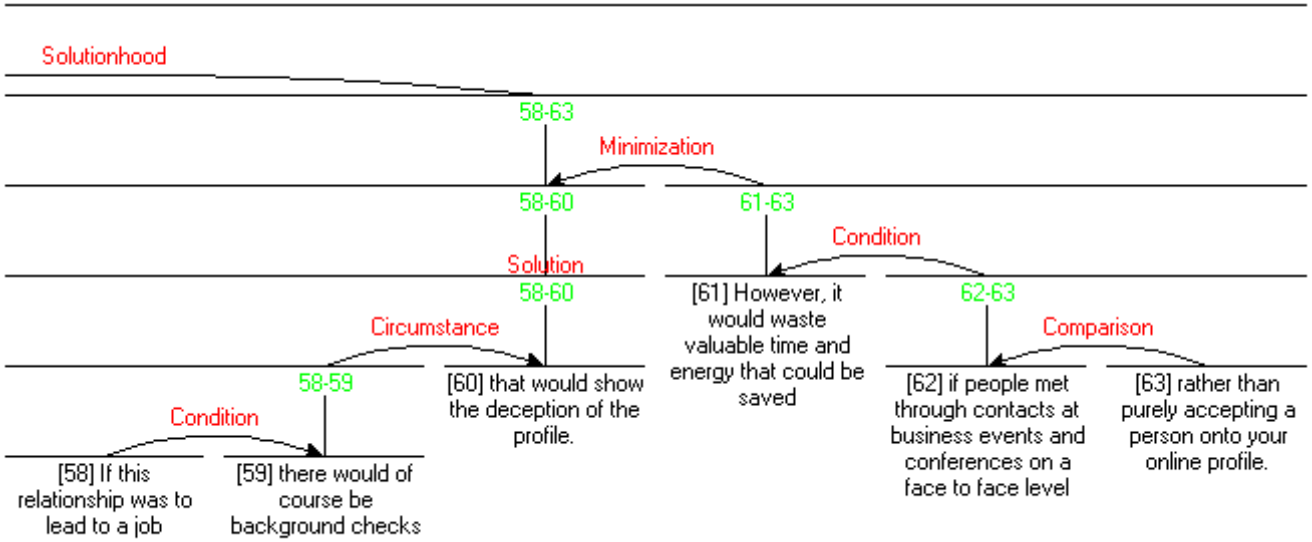

Evidence
10-17
Evidence
Elaboration
10-14
[15] and relationships built purely on the internet cannot enhance these vital social skills.
16-17
Evidence
Restatement
Comparison
[10] #Firstly, face to face interaction is a vital part of being human and developing social skills.
11-13
[14] These ways in which we communicate and interpret things are part of who we are as people
[16] Meeting a person face to face involves completely different ways of communication
[17] than simply clicking accept on a friend request.
11-13
Joint
11-12
[13] and it is something that carries on throughout our lives.
Circumstance
[11] Interpreting body language in people and learning to communicate is one of the first things we are taught
[12] when we are young
10-24
Position_c_sup
10-24
18-24
Restatement
18-20
21-24
Position_claim
Evidence
Position_claim
[18] It cannot therefore be said that
[19] finding friends on the internet is good for a person's social skills and mobility in life.
[20] By just having online friend's you miss out on important developments in the way one interacts with people.
[21] It is therefore clear that
22-24
Evidence
[22] relationships should not be built on social networking sites
23-24
List
[23] as it would be detrimental to a person's social development
[24] and make them miss out on important lessons in life.

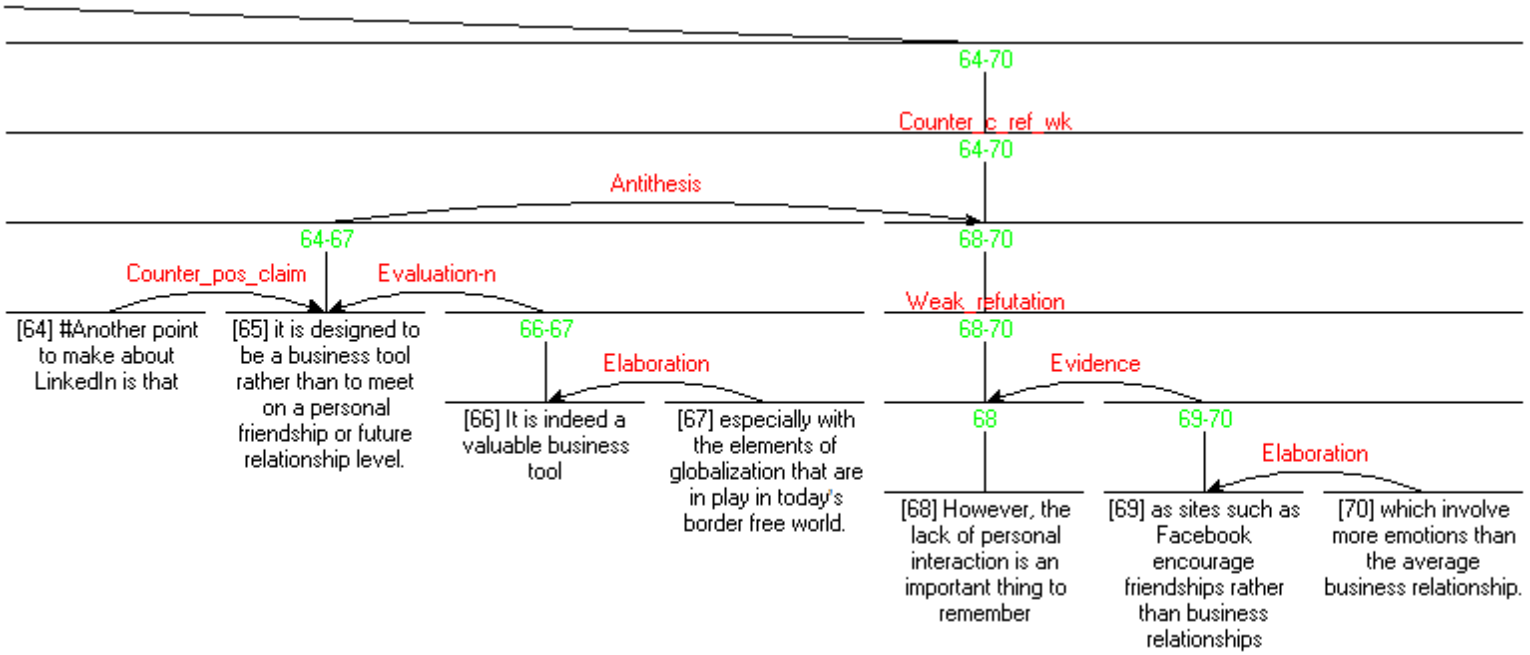

Evidence
25-32
25-32
Evidence
[25] #Secondly, people are not always who they say they are on the internet.
26-32
Elaboration
[26] There are stories in the media almost on a weekly basis of instances
27-32
Purpose
Elaboration
[27] where pedophiles and stalkers have been tracked down for creating profiles of younger people
28-29
List
[28] in order to lure children into feeling like they are friends
[29] and into a false sense of security.
30-32
Evidence
[30] It is easy to simply go to a social networking site anytime and set up a fake profile,
31-32
List
[31] there are no checks for this kind of thing and
[32] no laws saying that you have to be who you say you are on the internet.

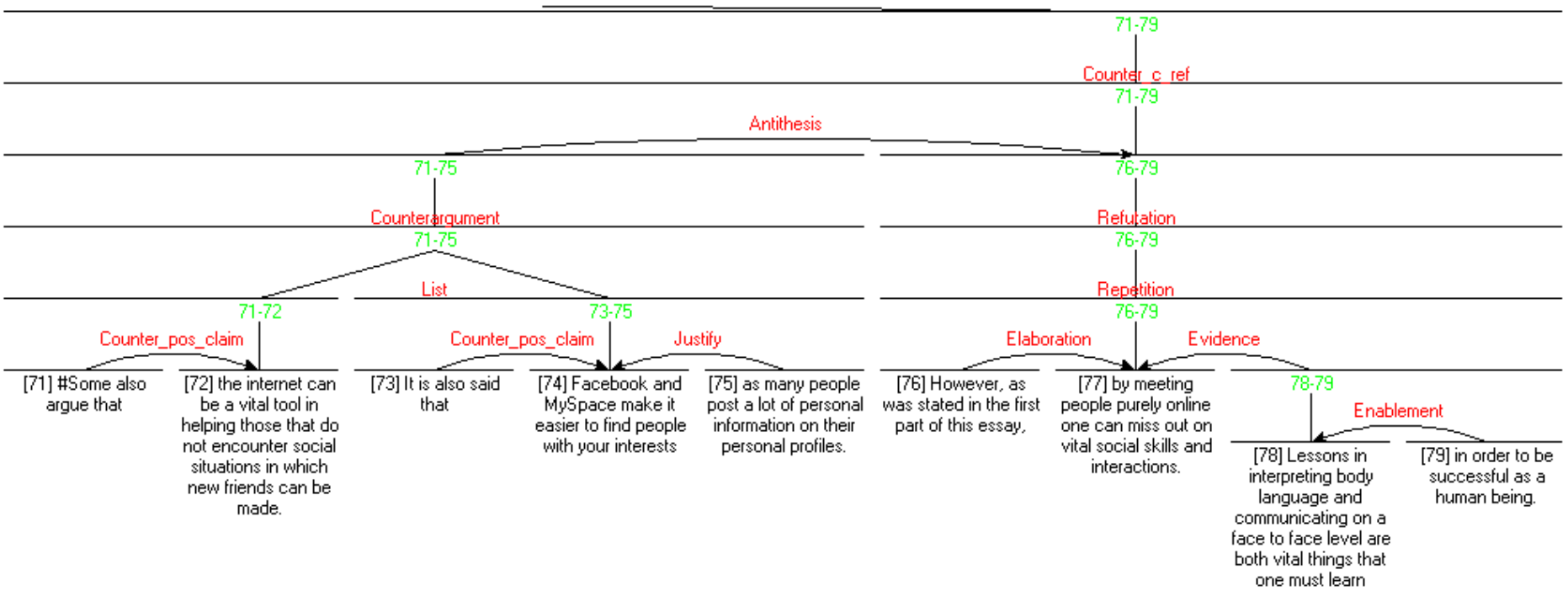

25-39
Position_c_sup
25-39
Motivation
25-37
38-39
Evidence
33-37
Position_claim
Evidence
[33] This is another argument for
[34] it not being beneficial to build and create relationships on the internet
35-37
Evidence
[35] as there is a definite danger involved.
36-37
Comparison
[36] Knowing who a person is outside of the screen is a lot safer
[37] than adding a complete stranger and building a relationship with them.
[38] We must therefore not encourage this kind of relationship building
[39] as it is potentially very dangerous.

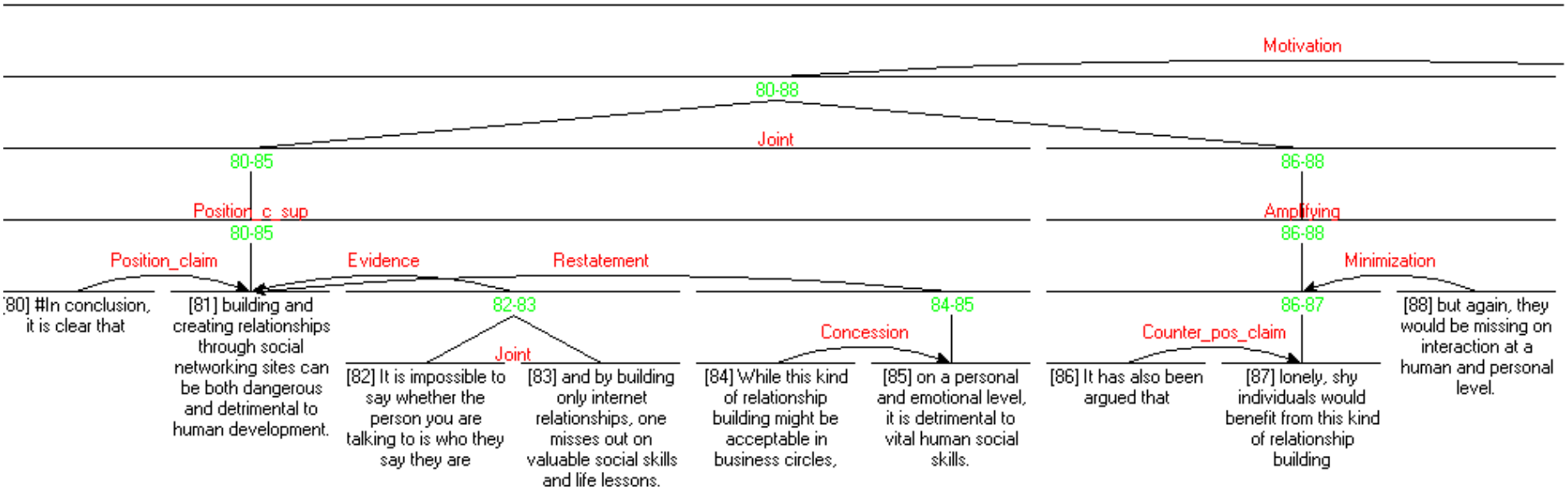

40-50
Syn_contingent
40-50
Background
Contingency
40-43
44-46
Example
Elaboration
[40] #Thirdly, sustaining relationships is the main focus of social networking sites for most people that join them.
41-42
[43] This is still a vital element of social networking sites today.
44-46
Example
Position
44-46
[41] One of the first social networking sites that I can remember was "Friend's Reunited"
[42] which to my memory was not set up to meet new people but instead catch up on old friends.
Evidence
[44] Personally, I have seen the benefits of sustaining friendships and relationships over the internet.
45-46
List
[45] Growing up in an ex-pat community meant that people often moved away
[46] and Facebook was and still is a great way to stay in touch.
47-50
Restatement
47-48
49-50
Comparison
Comparison
[47] However, it is important to see the difference in the idea of sustaining current relationships
[48] rather than creating and developing new friendships.
[49] Knowing a person on a more face to face personal level creates a whole different and better relationship
[50] to those that can be developed purely online.

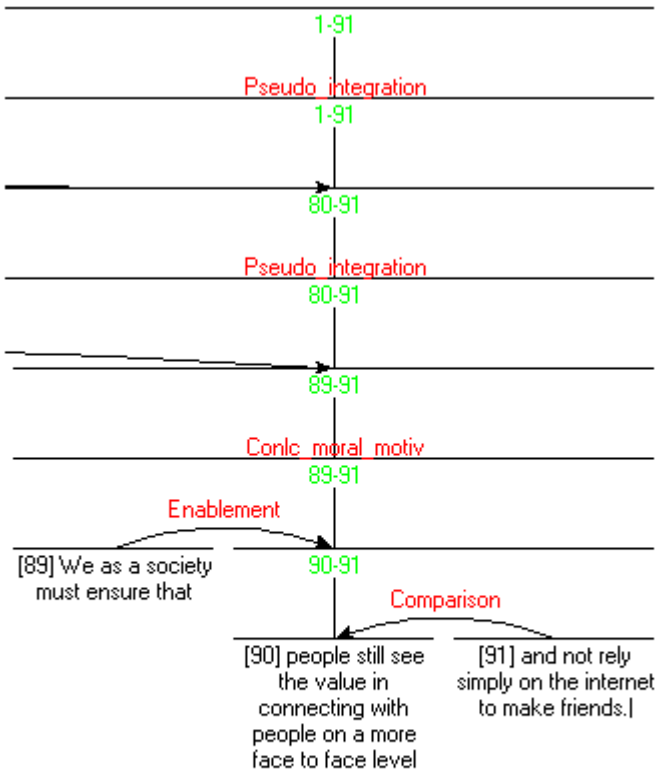

51-63
Weigh_minimization
51-63
Minimization
51-55
56-63
Counterargument
51-55
56-57
Counter_pos_claim
Example
Evidence
[51] #Some might say
52-54
[55] The social networking site LinkedIn is an example of a site which was created purely for business purposes and for these kinds of interactions.
[56] However, as with the more personal social networking sites such as Facebook or MySpace, one cannot guarantee that the person that created the profile is who they say they are.
[57] One could easily make up degrees and references on a social networking profile.
List
[52] that the idea of social networking is to meet new people
[53] and in the business world this is an important way to get more clients
[54] and possibly be headhunted for different positions.


Solutionhood
58-63
Minimization
58-60
61-63
Condition
Solution
58-60
[61] However, it would waste valuable time and energy that could be saved
62-63
Comparison
Circumstance
58-59
[60] that would show the deception of the profile.
[62] if people met through contacts at business events and conferences on a face to face level
[63] rather than purely accepting a person onto your online profile.
Condition
[58] If this relationship was to lead to a job
[59] there would of course be background checks


64-70
Counter_c_ref_wk
64-70
Antithesis
64-67
68-70
Counter_pos_claim
Evaluation-n
Weak_refutation
[64] #Another point to make about LinkedIn is that
[65] it is designed to be a business tool rather than to meet on a personal friendship or future relationship level.
66-67
68-70
Elaboration
Evidence
[66] It is indeed a valuable business tool
[67] especially with the elements of globalization that are in play in today's border free world.
68
69-70
Elaboration
[68] However, the lack of personal interaction is an important thing to remember
[69] as sites such as Facebook encourage friendships rather than business relationships
[70] which involve more emotions than the average business relationship.


71-79
Counter_c_ref
71-79
Antithesis
71-75
76-79
Counterargument
Refutation
71-75
76-79
List
Repetition
71-72
73-75
76-79
Counter_pos_claim
Counter_pos_claim
Justify
Elaboration
Evidence
[71] #Some also argue that
[72] the internet can be a vital tool in helping those that do not encounter social situations in which new friends can be made.
[73] It is also said that
[74] Facebook and MySpace make it easier to find people with your interests
[75] as many people post a lot of personal information on their personal profiles.
[76] However, as was stated in the first part of this essay,
[77] by meeting people purely online one can miss out on vital social skills and interactions.
78-79
Enablement
[78] Lessons in interpreting body language and communicating on a face to face level are both vital things that one must learn
[79] in order to be successful as a human being.


Motivation
80-88
Joint
80-85
86-88
Position_c_sup
80-85
Amplifying
86-88
Position_claim
Evidence
Restatement
Minimization
[80] #In conclusion, it is clear that
[81] building and creating relationships through social networking sites can be both dangerous and detrimental to human development.
82-83
84-85
86-87
[88] but again, they would be missing on interaction at a human and personal level.
Joint
Concession
Counter_pos_claim
[82] It is impossible to say whether the person you are talking to is who they say they are
[83] and by building only internet relationships, one misses out on valuable social skills and life lessons.
[84] While this kind of relationship building might be acceptable in business circles,
[85] on a personal and emotional level, it is detrimental to vital human social skills.
[86] It has also been argued that
[87] lonely, shy individuals would benefit from this kind of relationship building


1-91
Pseudo_integration
1-91
80-91
Pseudo_integration
80-91
89-91
Conlc_moral_motiv
89-91
Enablement
[89] We as a society must ensure that
90-91
Comparison
[90] people still see the value in connecting with people on a more face to face level
[91] and not rely simply on the internet to make friends.]

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